Biodiversity Assessment Report
The New Maitland Hospital
Metford NSW

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Prepared for: NSW Health Infrastructure

Date: 24 August 2018

KMH ENVIRONMENTAL

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Executive Summary

This Biodiversity Assessment Report (BAR) was prepared in accordance with the Framework for Biodiversity Assessment to accompany an Environmental Impact Statement (EIS) for the New Maitland Hospital (NMH) project. It relies in part on previous ecological investigations of the site by GHD (2013) and General Flora and Fauna (2014). Additional biodiversity offsetting work (10 Biobank plots/transects) was undertaken by **pitt&sherry** in July 2017 to assist with the completion of the Biobank assessment and to validate previous vegetation mapping.

The Site has been heavily disturbed in associated with historical extractive industry and brick making activities that have occurred across the Metford Triangle. It contains a mosaic of cleared land; artificial wetlands and stormwater ponds; and native rehabilitation plantings; as well areas of native vegetation described as Lower Hunter Spotted Gum-Ironbark Forest (LHSGIF) in the southwestern and south-eastern parts of the Site. The LHSGIF remnant is considered an Endangered Ecological Community (EEC) under the Biodiversity Conservation Act 2016 (BC Act) and is predicted to provide potential habitat for a variety of threatened fauna.

Targeted searches reveal that no threatened flora was observed on the Site. A total of 2 Threated fauna species were recorded on the proposed development site, these being the Squirrel Glider and Little Lorikeet.

The proposed development has been sited to minimise further disturbance and impacts to remnant vegetation. It will however result in the clearing of part of the LHSGIF remnant forest, either for the hospital building footprint or maintenance of an Asset Protection Zone (APZ). One threatened fauna species, the Squirrel Glider, was recorded within the development impact area, and one bird species (Little Lorikeet) and several microbat species are likely to forage within the remnant forest or adjacent open space. The species considered most likely to be impacted is the Squirrel Glider.

Mitigation measures are recommended to minimise the potential impacts of the development and include preparation of a Biodiversity Management Plan, development of clearing protocols, implanting pre-clearing surveys for threatened flora and fauna, and other impact mitigation measures during vegetation clearing. Supplementary planting is recommended in a cleared area along the southern boundary of the Site, to facilitate greater movement for the Squirrel Glider between stands of bushland on Lot 7314.

A Biodiversity Offset Strategy was prepared that outlines several options available to HI to meet their obligations based on the outcome of the Biobank Credit Calculator. Options include:

- Payment into the Biodiversity Conservation Fund (BCF) of an amount determined in accordance with the BAM biodiversity offset payment calculator;
- Purchase and retirement of open market available ecosystem and species credits in accordance with the Biodiversity Conservation Regulation 2016 offset and offset variation rules; and
- Establishment of a Biodiversity Stewardship Site.

The final offset method would be determined during detailed design and detailed in Stage 2 EIS submission.

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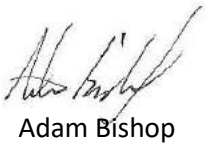
Prepared by:  Isaac Mamott Date: 24 August 2018

Reviewed by:  Adam Bishop Date: 24 August 2018

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1. Introduction

1.1 Background

Health Infrastructure (HI) commissioned **pitt&sherry** to prepare a Biodiversity Assessment Report (BAR) to accompany an Environmental Impact Statement (EIS), under a Part 5.2 State Significant Infrastructure (SSI) application, for the New Maitland Hospital (NMH) project. This BAR has been prepared in accordance with the EIS Secretary Environmental Assessment Requirements (SEARs) that require Biodiversity impacts, related to the proposal, to be assessed and documented in accordance with the Framework for Biodiversity Assessment, unless otherwise agreed by OEH, by a person accredited in accordance with s32 of the *Biodiversity Conservation (Savings and Transitional) Regulation 2017*. It is further noted that the NSW Office of Environment and Heritage (OEH) supports DP&E's decision that the proponent had been able to demonstrate that they had undertaken substantial environmental assessment for an environmental impact statement prior to 25 August 2017 when the Biodiversity Conservation Act 2016 commenced, and that the Savings and Transitional arrangements apply.

Previous ecological investigations on the former PGH/CSR quarry and brickworks site (Metford triangle) have been undertaken by GHD (2013) and General Flora and Fauna (2014) which have been relied upon to prepare this BAR. Additional biodiversity offsetting work (10 Biobank plots/transects) was undertaken in July 2017 across the NMH study area by **pitt&sherry** to assist with the completion of the Biobank assessment and to validate previous vegetation mapping.

In 2018, a review of this BAR was undertaken by Michael Murray of Forest Fauna Surveys. The purpose of this was to validate and advise on proposed mitigation measures specifically relating to fauna. Recommendations were provided with respect to fauna management and impact minimisation and have been incorporated within this BAR.

The BAR is structured as follows:

Section 1 – Background, Environmental Setting, Proposal Description Summary and Previous Ecological Investigations;
Section 2 – Biobank Assessment (Development scenario) to determine the offset requirements of the proposal through a development scenario that was run through the Biobank Credit Calculator (BBAM 2014/FBA 2014);
Section 3 – General Impact Assessment;
Section 4 – Mitigation Measures;
Section 5 – Biodiversity Offset Strategy (BOS) to outline how the proposal will meet its biodiversity offsetting obligations.

1.2 Environmental Setting

The BAR study area is defined as the SSI boundary which includes Lot 7314 and Part Lot 401 DP 755237 contained within a portion of the former PGH/CSR brickworks site known as the Metford Triangle. The study area is 19 hectares in area and supports a mosaic of forested habitats, stormwater ponds, rehabilitation shrub plantings, coal and spoil mounds in addition to cleared lands subject to site remediation works.

The study area is situated within the North Coast botanical subdivision (Anderson 1961), the Sydney Basin Bioregion (Thackway and Cresswell 1995), Newcastle Coastal Ramp Mitchell Landscape and Maitland City Council LGA.

The study area is mapped as being underlain with the Beresfield soil landscape group, comprising Permian-aged siltstone, mudstone and sandstone-derived silts, clays and sands. This regional mapping is generally consistent with site observations of topsoils and rock outcropping.

The western portion of the study area drains to the west to two-mile creek whilst the central and eastern portion drains to the east to an unnamed tributary of Three Mile Gully, which, in turn, all flow northward to the Morpeth and Tenambit wetlands on the northern side of the main northern railway line, ultimately discharging into the Hunter River.

Land use surrounding the study area comprises the remaining portion of the former quarry and brickworks site (Metford Triangle) to the east and immediate north; transmission line easement and Metford residential suburb to the south; Metford light industrial area and Fieldsend Oval to the west; main northern railway line and Tenambit and Morpeth wetlands to the distant north.

A site location map is provided as Figure 1.

A site boundary map is provided as Figure 2**.**

Figure 1 Site Location Map

Figure 2 Site Boundary Map

1.3 Proposal Description

A description of the NMH proposal is summarised below. The reader is referred to the EIS for a full proposal description.

HI is seeking approval for the NMH through a Staged Infrastructure Application. Two stages of the development are proposed.

- Stage 1: Concept proposal for the proposed development, site clearance and preparatory works
- Stage 2: Detailed Design and Construction of the New Maitland Hospital.

This application and EIS only addresses stage 1 of the Proposal. Stage 1 seeks approval of a Concept Design for the hospital (refer Figure 3) as well as Early Works involving site preparatory works and site clearance. The project development Footprint is shown in Figure 4.

Stage 1 Early Works would generally comprise:

- Site office and construction compound, including connection of compound to services
- Connection of temporary and permanent services for the new facility (water, sewer, power, gas)
- Removal of existing temporary fencing and installation of construction fencing and signage
- General clearance of site vegetation within the footprint of hospital construction works including tree stumps, but with retention of the majority of native vegetation around the site's perimeter in areas less impacted by historical mining activities. Asset Protection Zones (APZs) would be established for bushfire protection
- Chipping of cleared vegetation (excluding weed species) to use on site for ground stabilisation/erosion control in the period prior to commencement of Stage 2
- Offsite disposal of surplus cleared vegetation and weeds to green waste recycling facility or another beneficial reuse
- Bulk earthworks to establish the required site levels and create a stable landform in preparation for hospital construction
- Associated in-ground infrastructure and works may include formation of building foundations, drainage works and excavation of sub-level structures
- Site stabilisation (such as establishment of erosion and sediment controls) in preparation for Stage 2
- Site management
- Construction of internal un-sealed road ways for use during construction and in preparation for final road formation in Stage 2
- Construction of a hard, un-sealed sub-base for temporary construction parking spaces and in preparation for final carpark formation in Stage 2.

Stage 2 would include:

- Detailed design of Maitland Hospital
- Construction of Maitland Hospital
- Utility and services connection / amplification works
- Internal roadways and car parking for staff, patients and visitors
- External site works such as landscaping, pathways etc
- Hospital operation.

Figure 3 Site Masterplan

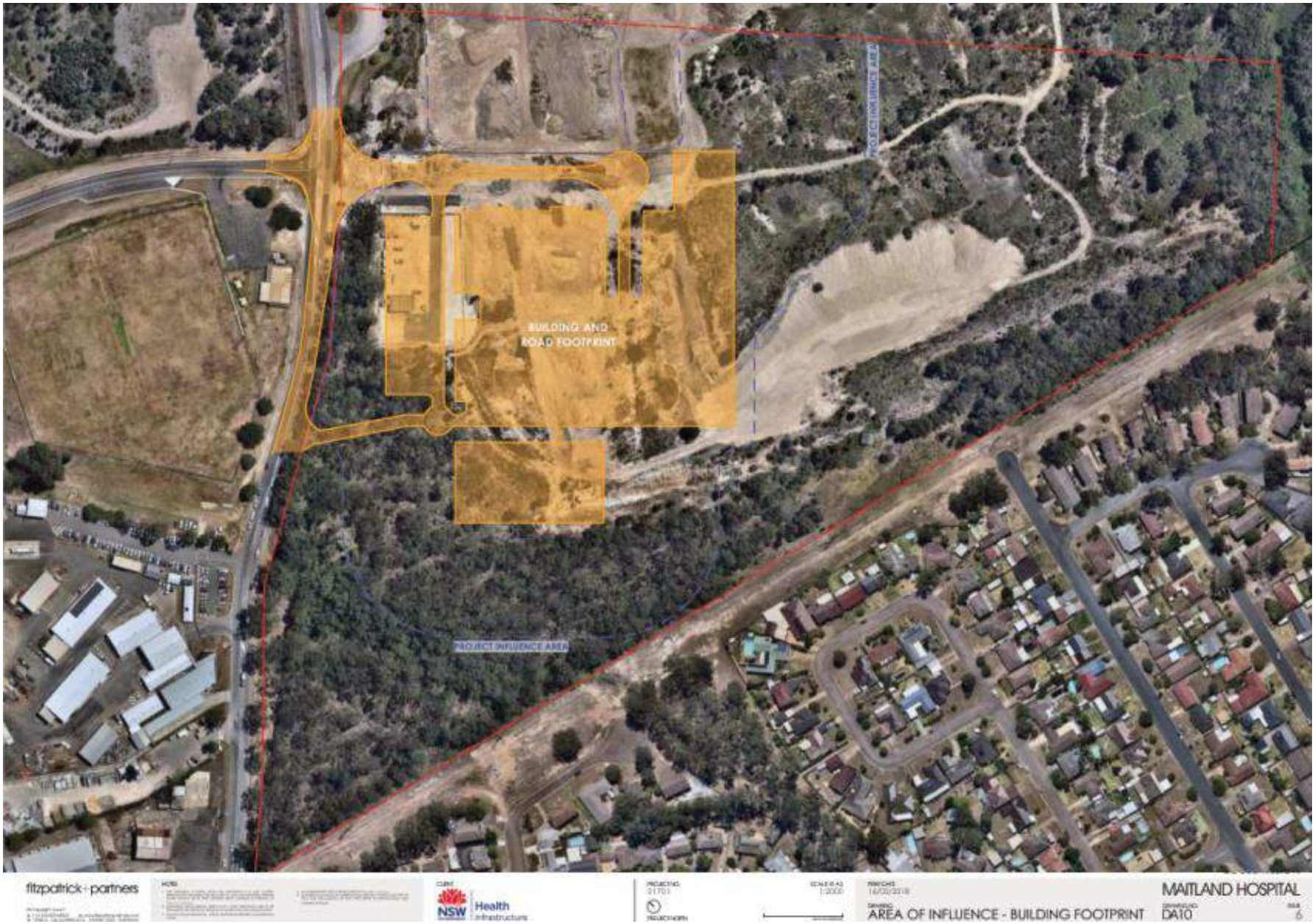

Figure 4 Development Overlay

1.4 Previous Ecological Investigations and Supporting Investigations

The former PGH/CSR brickworks site (Metford Triangle) has been subject to ecological investigations in 2013 (GHD) and 2014 (General Flora and Fauna). A summary of the methods and key survey results of these previous ecological investigations are provided below. These previous ecological investigations (particularly the extensive surveys undertaken by General Flora and Fauna) were relied upon to address the BBAM/FBA threatened species survey requirements for the current proposal as the surveys were carried out less than 5 years ago, and are thus still considered 'relevant' based on general industry assessment standards.

1.4.1 GHD (2013)

A suite of terrestrial flora and fauna surveys were undertaken across the entire Metford Triangle and adjoining lands to the west of Metford Road in August 2013, these being:

- 5 full floristic botanical plots
- Fauna habitat assessment
- Anabat microbat detection
- Call playbacks
- Spotlighting
- Camera trapping
- Active searching for reptiles.

GHD (2013) recorded a total of 4 vegetation types across the site, these being:

1. Lower Hunter Spotted Gum-Ironbark Forest (far south-eastern and far south-western corners)
2. Hunter Lowland Redgum Forest (central northern boundary)
3. Acacia regrowth
4. Artificial wetlands.

GHD (2013) noted that vegetation types 1 and 2 were analogous to the Lower Hunter Spotted Gum Ironbark Forest and Hunter Lowlands Redgum Woodland EECs listed under the former NSW *Threatened Species Conservation Act 1995* (TSC Act).

No Threatened flora species were recorded by GHD (2013).

A total of 2 Threatened species listed under the TSC Act were recorded by GHD (2013), these being:

- Little Bentwing Bat
- Grey headed Flying Fox.

GHD (2013) note that these 2 species utilise site habitats for foraging activity.

A copy of the GHD (2013) report is provided in **Appendix A**.

1.4.2 General Flora and Fauna (2014a)

A suite of baseline and targeted terrestrial flora and fauna surveys were undertaken by General Flora and Fauna across the Metford Triangle in September 2014 (incorporating the current NMH study area), these being:

- 9 full floristic botanical plots
- 8 straight line transects
- Small mammal trapping (4 trap lines with each trap line comprising Elliott A/Bs, cage traps and hair tubes)
- Anabat microbat detection
- Spotlighting
- Diurnal bird surveys
- Call playbacks
- Active searching for reptiles.

General Flora and Fauna (2014) recorded a total of 4 vegetation types across the site, these being:

1. Spotted Gum-Ironbark Forest (far south-eastern and far south-western corners)
2. Redgum Forest (central northern boundary)
3. Rehabilitation Plantings over disturbed land
4. Man-made ponds associated with storm water management and access track construction.

General Flora and Fauna (2014) noted that vegetation types 1 and 2 were analogous to the Lower Hunter Spotted Gum Ironbark Forest and Hunter Lowlands Redgum Woodland EECs listed under the former NSW *Threatened Species Conservation Act 1995* (TSC Act).

No Threatened flora species were recorded by GHD (2013) as part of their study.

A total of 7 Threatened species listed under the former TSC Act were recorded by General Flora and Fauna (2014), these being:

- Little Lorikeet
- Squirrel Glider
- Little Bentwing Bat
- Large Bentwing Bat
- Greater Broad Nosed Bat
- Large footed Myotis (also known as Southern Myotis)
- Grey headed Flying Fox.

A total of 2 of these 7 species (Little Lorikeet, Squirrel Glider) were recorded by General Flora and Fauna (2014) within the current study area, in particular within an area of Spotted Gum - Ironbark Forest remnant in the far south-western corner of Lot 7314 proposed for removal in part. General Flora and Fauna (2014) noted that the hollow bearing trees recorded on the site may provide potential nesting and denning habitat

for the species but did not provide further comment as to whether any of the HBTs were confirmed as denning/breeding habitat.

A total of 12 hollow bearing trees were recorded by General Flora and Fauna (2014) within the Spotted Gum-Ironbark Forest situated in the far south-eastern corner of the former brickworks site.

A total of 2 fauna survey sites (comprising trap lines and the full suite of survey methods employed) was located within the current project influence area, with each of the 2 fauna survey sites located in the 2 habitat stratification units, these being the spotted gum – ironbark forest and quarry plantings.

1.4.3 General Flora and Fauna (2014b)

Surveys targeting the Green and Golden Bell Frog as well as a suite of Threatened plants were carried out by General Flora and Fauna (2014b) in October, November and December 2014 across the greater Metford brickworks site in all suitable habitats (forest, ponds) through call playbacks and parallel line transect searches.

No Threatened species were recorded during these surveys despite dedicated searches for them.

GHD (2013) and General Flora and Fauna (2014a; 2014b) are reproduced in full and provided as **Appendix A**.

1.4.4 Forest Fauna Surveys, Review (2018)

A review of this Biodiversity Assessment Report was undertaken by Forest Fauna Surveys (2018). A copy is provided in **Appendix B**.

The basis of the review is to consider the adequacy of previous assessments specific to threatened fauna, and whether the proposed action will impact upon threatened fauna. This report also provides recommendations to assist with fauna management and impact minimisation which have been incorporated within the BAR. The peer review included a site inspection and foot traverse of the area of influence to inspect habitat values of the remnant forest for threatened fauna.

The review determined that the totality of previous investigations result in collation of a comprehensive dataset regarding site fauna and their habitats. No further fauna surveys are considered necessary in order to adequately assess the impact of the proposed development on threatened fauna. This peer review supports the BAR findings that there would not be a significant impact on any threatened species.

2. Biobank Assessment (Site based Major Project - Development scenario)

2.1 General

A site based, major project development scenario was run through the current version of the Biobank Credit Calculator on 11 August 2017 and 23 August 2018 by accredited assessor, Isaac Mamott (BBAM accreditation number 0081). Quarry rehabilitation plantings and man-made ponds formed from altered drainage associated with the construction of an internal quarry access road were included in the Biobank assessment as native Plant Community Types (PCTs). The rehabilitation plantings (which may also include some naturally regenerating taxa) predominantly occur on the quarry floor, on spoil mounds and on stockpile batters whilst the ponds have been created from altered drainage associated with past quarrying activity and the construction of an access track on the quarry void floor. None of the ponds (which do support native aquatic vegetation that have recruited into them) are considered to be naturally occurring wetlands based on presumed pre-quarry landforms but have been included in the BBAM assessment as per OEH's recommendation

2.2 Landscape Value

The site's Landscape Value is scored based on 4 variables, these being Percentage (%) Native Vegetation Cover, Connectivity Width, Connectivity Condition and Patch Size, all of which are discussed below.

2.2.1 Landscape Assessment Circles (Percentage Native Vegetation Cover)

For the Landscape Value assessment, a change in the areal extent (%) of native vegetation in the immediate and wider locality as a result of the proposal is used, in part, to calculate Ecosystem Credits that would need to be purchased and retired to offset the loss in biodiversity. In general, a 'larger' reduction in the cover of native vegetation as a result of a proposal equates to a greater number of Ecosystem Credits needed for offsetting compared with a 'smaller' reduction in vegetation cover requiring fewer credits to offset.

Two landscape assessment circles, being 100 and 1000 hectares in area (corresponding to 564 and 1784 metre radius circles), were centred over the study area using online LPI 50cm resolution digital aerial imagery and GIS software (ArcMap 10.5). Percentage native vegetation cover within each assessment circle was determined for the 'Before' and 'After' development scenario through mapping all areas of remnant vegetation occurring inside each assessment circle via polygon editing tools in Arcmap and calculating the total mapped extant area of vegetation and dividing by 100 and 1000 respectively. The 1000-hectare assessment circle was also used to identify Threatened species that may occur in the study area.

Results of the percent native vegetation cover assessment is shown below in Table 1. Within the smaller 100-hectare (inner) assessment circle, there was a change in vegetation class cover from 26-30% to 21-25% associated with the reduction in vegetation cover as a result of the proposal. The change in vegetation class cover is considered an over-estimate as we have assumed complete vegetation removal in the asset protection zone. If we had taken a less precautionary approach and assumed complete vegetation retention in the APZ, there would not have been a change in vegetation class cover. Within the larger 1000-hectare (outer) assessment circle, there was no change in the vegetation cover class associated with the proposal (21-25%).

Table 1 Percentage (%) of Native Vegetation Cover

	% Native Vegetation Cover Before Development	% Native Vegetation Cover After Development
Outer assessment circle	21-25 (231.96 ha out of 1000 ha)	21-25 (226.76 ha out of 1000 ha)
Inner assessment circle	26-30 (29.9 ha out of 100 ha)	21-25 (24.7 ha out of 100 ha)

The landscape assessment circles and associated mapped native vegetation polygons are shown below in Figure 5.

2.2.2 Connectivity Value

Connectivity Value Class

The proposal does not impact any of the following connectivity value classes and thus none of those listed below were selected as part of the landscape value assessment:

- Riparian buffer of a 6th order stream or higher (50m)
- Riparian buffer of an important wetland (50m)
- Riparian buffer of an estuarine area (50m)
- State or regionally significant biodiversity link
- Riparian buffer of a 4th or 5th order stream (20m).

Connectivity Width

A desktop connectivity width assessment was undertaken to determine the existing or current Linkage Width Class for the development site. The current Linkage Width is defined as the width (in metres) of native vegetation that represents the narrowest (or most limiting) link that connects development site vegetation to adjoining vegetation as long as the development site vegetation is a PCT that is in moderate to good condition with a patch size > 1 hectare and does not form a major barrier to movement to adjoining vegetation by way of a dual carriageway highway or other hostile corridor. The current Linkage Width was identified as occurring along the south-eastern boundary of the development site (project influence area). The current Linkage Width was calculated to be approximately 93 metres, placing the development into a Linkage Width Class of >30m-100m. The connecting link connects development site vegetation on Lot 7314 to both a small woodland patch to the south across a 20-25-metre-wide powerline easement situated at the end of Tennyson street cul-de-sac as well as to adjoining vegetation on Lot 7314 to the immediate east. Whilst the connecting link traverses a powerline easement, it is considered to be negotiable for mobile fauna (birds, bats) and tenuously negotiable for the Squirrel Glider.

It was then necessary to assess whether there was likely to be a change in the existing Linkage Width Class as a result of vegetation clearing associated with the proposal. In other words, would the proposal result in a reduction of linkage width and if so would it result in the development site being placed into a correspondingly lower Linkage Width Class. Whilst the proposal would require the establishment of an asset protection zone (APZ) at the connecting link, the APZ would impact upon the condition of the vegetation link (reduction in canopy cover through selective removal of trees) but not the linkage width itself and thus no change to the linkage width class was input into the credit calculator.

Linkage width calculations are provided in Table 2.

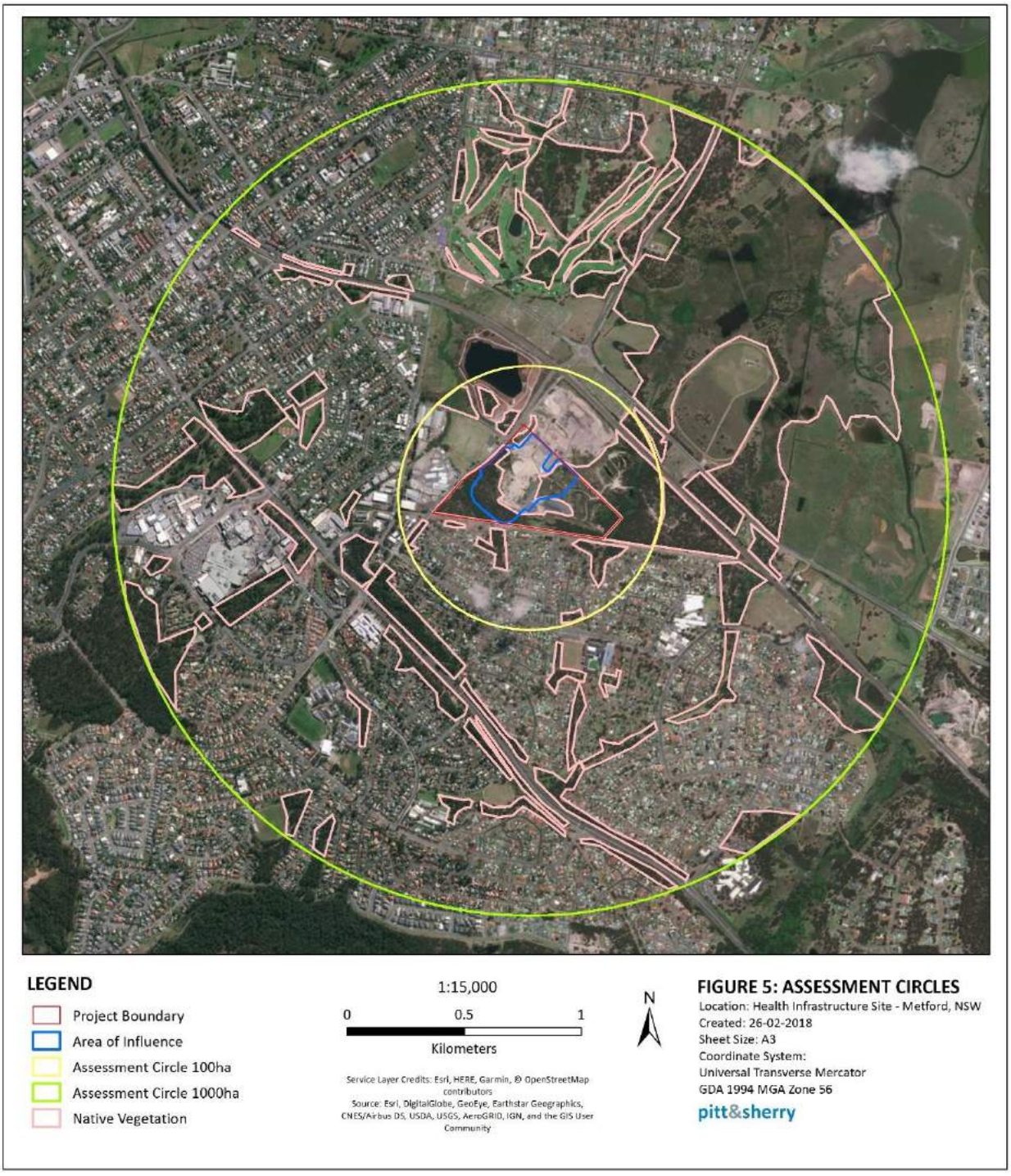

Figure 5 Landscape Assessment Circles

Table 2 Linkage Width Class

	Linkage Width (m)	Linkage Width Class (m)
Before Development	93	>30-100m
After Development	93	>30-100m

Connectivity Condition

A desktop connectivity condition assessment was undertaken by assessing the average condition of native vegetation at the development site's connecting link to adjoining vegetation. An adverse change in the average condition of linking vegetation as a result of the proposal (through clearing or thinning) will drive the creation of Ecosystem Credits required for offsetting the loss of biodiversity at the connecting link. The connecting link supports a forest PCT (lower hunter spotted gum-ironbark forest) and thus 2 connectivity condition variables were assessed at the connecting link, these being native overstorey and native mid storey/groundcover Projected Foliage Cover (PFC). Each of these 2 variables or attributes were placed into one of the following 4 connectivity condition classes in the Credit Calculator:

Native overstorey

- No native overstorey
- PFC < 25% of the lower Benchmark value of the PCT
- PFC > 25% of the lower Benchmark value of the PCT
- PFC at Benchmark value.

Native Midstorey/Groundcover

- No native midstorey/groundcover
- PFC < 50% of the lower Benchmark value of the PCT
- PFC > 50% of the lower Benchmark value of the PCT
- PFC at Benchmark value.

Benchmark values for a range of variables (including native overstorey, native midstorey and native groundcover PFC) are listed for all Plant Community Types (PCTs) in the Vegetation Information System (VIS 2.1). Interpretation of Google Earth and Nearmap imagery in conjunction with ground truthing as part of the conduct of Biobank plots/transects was used to determine the condition of the connecting link vegetation. 'Before and after development' connecting link vegetation condition classes input in to the credit calculator are shown below in Table 3.

Table 3 Connectivity Condition Class

	Over storey	Mid storey/Groundcover
Before Development	PFC at benchmark	PFC at benchmark
After Development	PFC at benchmark	PFC at benchmark

Results from Table 3 show no reduction in vegetation condition for both over storey and midstorey/groundcover as a result of APZ establishment.

2.2.3 Patch Size and Mitchell Landscape

Patch Size

Patch size is an area of native vegetation that:

- Occurs on the development site
- Is in moderate to good condition
- Includes woody native vegetation that has a gap of <100 metres from the next area of moderate to good condition native vegetation (<30 metres for non-woody ecosystems).

Patch size may extend onto lands adjoining the development site.

The vegetation on the development site links to:

1. riparian corridors associated with three-mile gully and four-mile creek to the east of Lot 7314 and the greater Metford triangle which in turn link to more extensive tracts of forested bushland at Ashtonfield to the north and south of the New England Highway
2. floodplain woodlands and freshwater wetlands associated with Tenambit wetlands and golf course on the northern side of the railway line.

Native vegetation on the development site and adjoining patch vegetation combined to form at least a 500-hectare remnant area and thus a 501-hectare patch size value was input into the credit calculator. Patch size of the remnant bushland is shown in Figure 6.

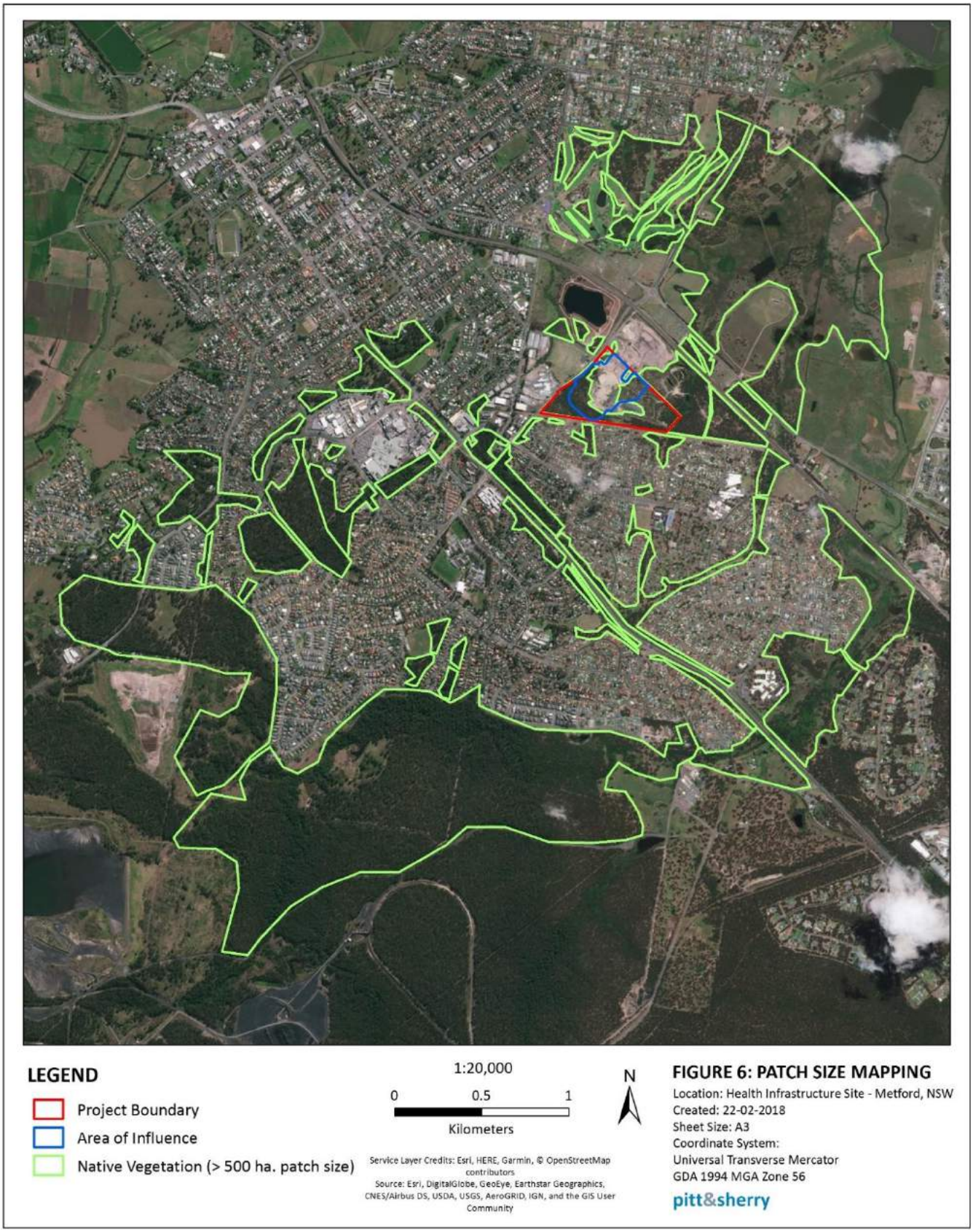

Figure 6 Patch Size Mapping

Mitchell Landscape

The Mitchell Landscape spatial dataset (v3) was imported to arcmap to determine the Mitchell landscape mapped for the develop site, this being 'Newcastle Coastal Ramp'.

Data for Percentage Native Vegetation Cover, Connectivity and Patch Size combined to give a Landscape Score of 15.8.

2.3 Biobank Vegetation Zones

Ground truthing associated with an initial site reconnaissance and the Biobank surveys identified a total of 4 Vegetation Zones from 2 PCTs across the study area, listed below in Table 4 and shown in Figure 7**.**

Table 4 Vegetation Zones

Vegetation Zone Number	Plant Community Type (PCT)	Areal extent within Construction and Development Footprint Area (ha)(Project Influence Area)	Condition Class	EEC (BC Act)
1	Spotted Gum-Red Ironbark-Grey Gum shrub-grass Open Forest of the Lower Hunter (HU806; PCT ID 1592)	2.05	Moderate/Good – Medium	EEC (Lower Hunter Spotted Gum-Ironbark Forest)
2	Spotted Gum-Red Ironbark-Grey Gum shrub-grass Open Forest of the Lower Hunter (HU806; PCT ID 1592)	0.4	Moderate/Good – Poor	EEC (Lower Hunter Spotted Gum-Ironbark Forest)
3	Spotted Gum-Red Ironbark-Grey Gum shrub-grass Open Forest of the Lower Hunter (HU806; PCT ID 1592) – Native Plantings and Natural Regeneration	2.53	Low	EEC (Lower Hunter Spotted Gum-Ironbark Forest)
4	*Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion. (PCT ID 1071) – Man made ponds.	0.17	Moderate/Good - Medium	Freshwater wetlands on coastal floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (EEC);

Vegetation Zone Number	Plant Community Type (PCT)	Areal extent within Construction and Development Footprint Area (ha)(Project Influence Area)	Condition Class	EEC (BC Act)
				Sydney Freshwater Wetlands in the Sydney Basin Bioregion (EEC)

The Spotted Gum-Ironbark PCT recorded in the development site was arbitrarily stratified into the 2 Vegetation Zones based on a markedly reduced native midstorey and groundcover species richness associated with areas of Lantana infestation (Veg Zone 2) relative to areas with sparse to moderate weed cover and correspondingly higher species richness closer to benchmark values (Veg Zone 1). Vegetation zone 2 also corresponded to a moist variant of Vegetation Zone 1, occurring along an ephemeral drainage line in the far south-western bushland remnant of the study area which drains west to two-mile creek. This defined but shallow ephemeral drainage line supported a similar suite of overstorey species as per Vegetation Zone 1 but comprised a dense, closed exotic-dominated mid stratum of Small leaved Privett and Camphor Laurel. Evidence of previous sewerage infrastructure works in the vicinity of the drainage line may have altered the hydrology and floristics of this portion of the study area.

Both GHD (2013) and General Flora and Fauna (2014) mapped this ephemeral drainage line as lower hunter spotted gum ironbark forest with no differentiation between it and the adjoining LHSGIF vegetation on slightly higher ground. Interestingly, the 2010 LHSGIF EEC spatial dataset (VIS ID 2319) does not map this ephemeral drainage line as LHSGIF. This is not surprising as the mapping was based on Hill (1998) who likely had not visited the site and based on position in the landscape logically assumed a drainage line would not support this vegetation type (as LHSGIF typically grades into Hunter Lowland Redgum Woodland (HLRW)) in open depressions where drainage is at least partially impeded (as it does in other areas within the greater Metford triangle outside Lot 7314).

Given the absence of dominant canopy species characteristic of the HLRW community (e.g. *Eucalyptus tereticornis, Angophora floribunda*) within sections of the ephemeral drainage line ground truthed by **pitt&sherry**, we generally concur with the GHD (2013) and Flora and Fauna (2014) mapping and have not modified it as such. We acknowledge, however, that the drainage line vegetation does not represent the typical main 'variant' identified for LHSGIF present on the adjoining drier areas of the site, given the replacement of characteristic dry shrub and grass species associated with the LHSGIF EEC with a dense exotic-dominated small tree stratum, presumably established from previous sewerage infrastructure works.

A linear band of Forest Red Gum (*Eucalyptus tereticornis*) was also recorded fringing a small section of the western boundary fence line (south of the proposed main hospital entrance) where it is thought that previous earthworks had created a minor localised gully or depression. It is considered unlikely that this area once comprised a naturally occurring depression supporting a Hunter Lowland Redgum Woodland habitat based on surrounding landforms. It is likely that this species was planted in this area or has recruited from the many Forest Red Gum rehabilitation plantings occurring throughout Lot 7314. This area was also considered to be too small to be mapped at a reasonable scale and was incorporated into Vegetation Zone 1.

Two (2) small man-made ponds (comprising approximately 100m^2) were recorded within Vegetation Zone 1 (far south-western corner of the study area) which were presumably the result of previous quarrying activity. Native and exotic aquatic vegetation had recruited into and on the edges of the ponds, although their anthropogenic nature precludes them from being classified as freshwater wetlands. These ponds are too small to be mapped at a reasonable scale and have similarly been incorporated into Vegetation Zone 1.

Two additional vegetation zones were recorded within Lot 7314 project boundary, these being:

- Vegetation zone 3 - Acacia and eucalypt tree plantings on the quarry floor, spoil mounds, quarry and coal stockpile batters which have been classified as low condition LHSGIF PCT; and

- Vegetation zone 4 - Man-made ponds located to the north of the coal stockpile on the quarry floor which are currently used for stormwater management and created from previous quarrying activity (ie. altered drainage from construction of quarry access road). Although the ponds have been colonised with native aquatics and have some floristic affinity with the Coastal Floodplain Freshwater Wetland EEC listing under the BC Act, they are not considered to be representative of a naturally occurring PCT/EEC given their anthropogenic nature. That is, prior to quarrying, the area the ponds occur in would be expected to have supported a LHSGIF community given the pre-quarrying landform that would have occurred onsite. Nevertheless, they have been included as a coastal freshwater wetland PCT as per OEH's recommendation.

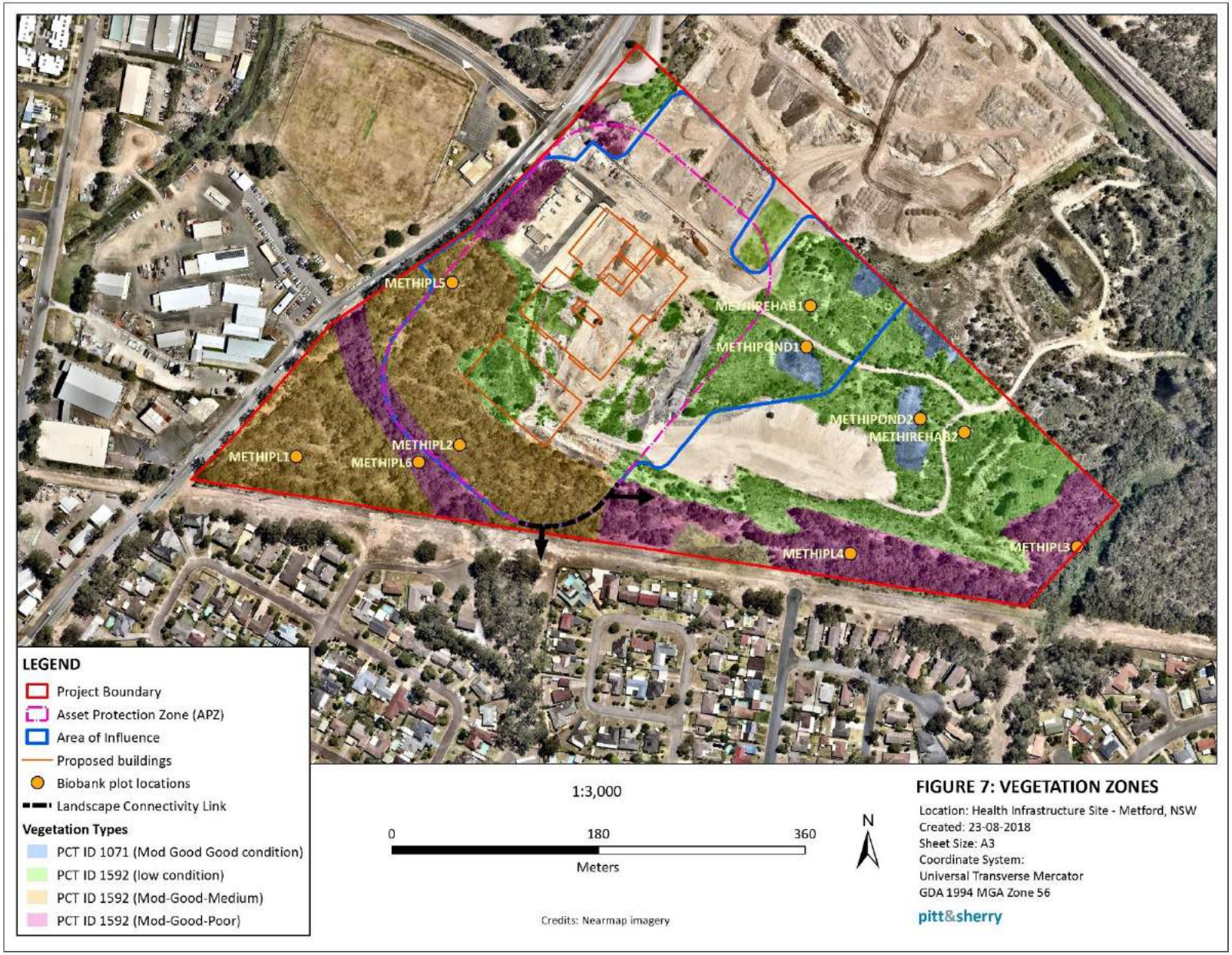

Figure 7 Vegetation Zones Map

2.4 Geographic and Habitat Features

Step 5 in the Credit Calculator asks whether a suite of Geographic and Habitat Features (GHFs) associated with specific Threatened flora and fauna species occur on the development site. Table 5 lists the GHFs shown in the Credit Calculator for consideration and our assessment of their occurrence on the development site.

Table 5 Geographic/Habitat Features

Geographic/Habitat Feature	Relevant Threatened Species	GHF occurring on the development site
Rainforest, eucalypt forest, heathland, marshland, grassland or rocky areas.	Common Planigale (*Planigale maculata*)	Yes
Land within 100 m of emergent aquatic or riparian vegetation.	Green and Golden Bell Frog (*Litoria aurea*)	Yes
Land within 100 m of semi-permanent or ephemeral ponds or depressions containing leaf litter.	Green thighed Frog (*Litoria brevipalmata*)	Yes
land containing escarpments, cliffs, caves, deep crevices, old mine shafts or tunnel	Large eared Pied Bat (*Chalinolobus dwyeri*)	No
Heath on sandy soils or moist areas in open forest	Heath Wrinklewort (*Rutidosis heterogama*)	Yes
Land within 40 m of watercourses, containing hollow-bearing trees, loose bark and/or fallen timber	Pale headed Snake (*Hoplocephalus bitorquatus*)	Yes
Land within 1 km of rock outcrops and clifflines	Brush-tailed Rock-wallaby (*Petrogale penicillata*)	No
Deep low nutrient sands	*Eucalyptus parramattensis subsp decadens*	No

2.5 Threatened Species 'Species Credits'

Step 6 'Site Survey Details' of the Credit Calculator lists a total of 21 Threatened flora and fauna species which are classed as species credit species requiring targeted survey on the site with an accompanying survey time matrix. None of those species credit species listed were recorded on the site by GHD (2013) nor General Flora and Fauna (2014) as part of previous site surveys and all were surveyed at the appropriate times of year. A survey time matrix is provided in Table 6. Survey methodologies and timing are prescribed in GHD (2013) and General Flora and Fauna (2014) which have been reproduced as **Appendix A** of this BAR.

Table 6 Species Credit Species Survey Time Matrix

Common name	Scientific name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Black-eyed Susan	*Tetratheca juncea*							Yes	Yes	Yes	Yes	Yes	Yes
Brush-tailed Phascogale	*Phascogale tapoatafa*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bynoe's Wattle	*Acacia bynoeana*	Yes	Yes	Yes						Yes	Yes	Yes	Yes
Common Planigale	*Planigale maculata*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Green and Golden Bell Frog	*Litoria aurea*	Yes	Yes	Yes					Yes	Yes	Yes	Yes	Yes
Green-thighed Frog	*Litoria brevipalmata*	Yes	Yes	Yes							Yes	Yes	Yes
Heath Wrinklewort	*Rutidosis heterogama*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Koala	*Phascolarctos cinereus*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Leafless Tongue Orchid	*Cryptostylis hunteriana*	Yes	Yes									Yes	Yes
Netted Bottle Brush	*Callistemon linearifolius*	Yes	Yes	Yes						Yes	Yes	Yes	Yes
North Rothbury Persoonia	*Persoonia pauciflora*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pale-headed Snake	*Hoplocephalus bitorquatus*	Yes	Yes	Yes	Yes						Yes	Yes	Yes
Regent Honeyeater	*Anthochaera phrygia*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rough Doubletail	*Diuris praecox*							Yes	Yes				
Scant Pomaderris	*Pomaderris queenslandica*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Singleton Mint Bush	*Prostanthera cineolifera*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Slaty Red Gum	*Eucalyptus glaucina*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Small Snake Orchid	*Diuris pedunculata*									Yes	Yes	Yes	

Common name	Scientific name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Small-flower Grevillea	*Grevillea parviflora* subsp. *parviflora*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
White-flowered Wax Plant	*Cynanchum elegans*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Step 6 'Site Survey Details' of the Credit Calculator lists a total of 19 Threatened flora and fauna species predicted to occur on the development site. Whilst only two of the predicted Threatened species were actually recorded on the development site from previous surveys (Little Lorikeet and Squirrel Glider), the majority of the predicted Threatened species listed in the credit calculator were left as being present on the site based on the presence of suitable habitat and thus treated as a possible occurrence. The exception to this were the Speckled Warbler and Painted Honeyeater which were assessed as not being on site based on an absence of suitable habitats and thus were edited as such in the credit calculator (refer Table 6 below for justification for removal of these 2 taxa from the predicted species list). The predicted Threatened taxa listed in the credit calculator are shown below in Table 7.

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Table 7 Predicted Threatened Species

Common Name	Scientific Name	Credit Class	Ticked in credit calculator as being present on site
Black chinned Honeyeater (eastern subspecies)	*Melithreptus gularis subsp. gularis*	Ecosystem	Yes, although typically very rare on the coast with rare scattered records in the Hunter. Species not recorded by GHD (2013) or General Flora and Fauna (2013) as part of field surveys.
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus subsp. victoriae*	Ecosystem	No, Suitable habitat not present as shrub layer is likely too dense in the LHSGIF remnants. Species not recorded by GHD (2013) or General Flora and Fauna (2013) as part of field surveys.
Bush Stone-curlew	*Burhinus grallarius*	Species	Yes, suitable habitat present. Species not recorded by GHD (2013) or General Flora and Fauna (2013) as part of field surveys.
Diamond Firetail	*Stagonopleura guttata*	Ecosystem	Yes, although a likely rare visitor to the lower Hunter. Species not recorded by GHD (2013) or General Flora and Fauna (2013) as part of field surveys.
Gang-gang Cockatoo	*Callocephalon fimbriatum*	Dual Ecosystem/Species	Yes, suitable overwintering habitat is present. Species not recorded by GHD (2013) or General Flora and Fauna (2013) as part of field surveys
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	Dual Ecosystem/Species	Yes, although its feed trees are not in abundance and thus likely to support only very small numbers of individuals if present. Species not recorded by GHD (2013) or General Flora and Fauna (2013) as part of field surveys
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis subsp. temporalis*	Ecosystem	Yes, suitable habitat present. Species not recorded by GHD (2013) or General Flora and Fauna (2013) as part of field

Common Name	Scientific Name	Credit Class	Ticked in credit calculator as being present on site
			surveys.
Hooded Robin (south-eastern form)	*Melanodryas cucullata subsp. cucullata*	Ecosystem	Yes, although preferred open woodland habitat not present on development site. Species not recorded by GHD (2013) or General Flora and Fauna (2013) as part of field surveys.
Little Eagle	*Hieraaetus morphnoides*	Dual Ecosystem/Species	Yes, suitable habitat present. Species not recorded by GHD (2013) or General Flora and Fauna (2013) as part of field surveys.
Little Lorikeet	*Glossopsitta pusilla*	Ecosystem	Yes, Recorded by General Flora and Fauna (2014) in LHSGIF habitat on development site.
Masked Owl	*Tyto novaehollandiae*	Dual Ecosystem/Species	Yes, suitable habitat present. Species not recorded by GHD (2013) or General Flora and Fauna (2013) as part of field surveys.
Painted Honeyeater	*Grantiella picta*	Ecosystem	No, Suitable habitat not present. Species not recorded by GHD (2013) or General Flora and Fauna (2013) as part of field surveys.
Powerful Owl	*Ninox strenua*	Dual Ecosystem/Species	Yes, suitable habitat present. Species not recorded by GHD (2013) or General Flora and Fauna (2013) as part of field surveys.
Scarlet Robin	*Petroica boodang*	Ecosystem	Yes, suitable habitat present. Species not recorded by GHD (2013) or General Flora and Fauna (2013) as part of field surveys.
Speckled Warbler	*Chthonicola sagittata*	Ecosystem	No, Species not recorded by GHD (2013) or General Flora and Fauna (2013) as part of field surveys.
Swift Parrot	*Lathamus discolor*	Dual Ecosystem/Species	Yes, overwintering foraging habitat present. Species not recorded by GHD

Common Name	Scientific Name	Credit Class	Ticked in credit calculator as being present on site
			(2013) or General Flora and Fauna (2013) as part of field surveys.
Turquoise Parrot	*Neophema pulchella*	Ecosystem	Yes, suitable habitat present. Species not recorded by GHD (2013) or General Flora and Fauna (2013) as part of field surveys.
Varied Sitella	*Daphoenositta chrysoptera*	Ecosystem	Yes, suitable habitat present. Species not recorded by GHD (2013) or General Flora and Fauna (2013) as part of field surveys.
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	Ecosystem	Yes, suitable species present. Species not recorded by GHD (2013) or General Flora and Fauna (2013) as part of field surveys.

2.6 Vegetation Plot/Transect Data

A total of 10 Biobank biometric plots/transects were carried out within Lot 7314, 6 within LHSGIF habitats, 2 within the man-made ponds and 2 within the rehabilitation plantings/regrowth habitat. Each biometric plot/transect survey site comprised the establishment of a 400m^2 (20m x 20m) quadrat nested within a larger 0.1-hectare plot (dimension = 20m x 50m) along with a 50-metre-long transect bisecting the two plots. Data collected within the nested plot comprised full floristics, elevation, slope, aspect, topographic position and soil type. Data collected within the larger plot comprised a census of hollow bearing trees and length of fallen logs. Structural vegetation information (foliage cover for all strata) was recorded along the transect. Completed Biobank plot/transect proformas are provided as **Appendix C**.

Survey effort (number of plots/vegetation zone) met or exceeded the minimum Biobank field survey requirements for all vegetation zones identified (refer Table 8 shown below). Vascular flora species recorded were identified as far as practicable to species and subspecies level. When a plant could not be identified accurately in the field, a voucher sample was collected, together with notes on habitat, form and height. Collected samples were later identified using a stereozoom microscope and botanical texts. Botanical nomenclature followed the Harden series of Flora of NSW Volumes 1-4 (including revised Volumes 1 and 2) and 'PlantNet' website.

Transect/plot data for the four (4) Vegetation Zones was entered into the 'Site Values' section of the Credit Calculator and is reproduced below in Table 8.

The location of the 10 Biobank plot/transect locations are shown in Figure 7**.**

Table 8 Biobank Plot Data

Plot ID #	Plant Species Richness	Native Over-storey Cover (%)	Native Mid Storey Cover (%)	Native Ground Cover – grasses (%)	Native Ground Cover – shrubs (%)	Native Ground Cover – other (%)	Exotic Plant Cover	# Tree Hollows	Overstorey Regeneration	Length Fallen Logs (metres)	AMG Grid Refs GDA94
Veg Zone 1 –Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter - Moderate/Good – Medium Broad Condition Class (2 plots completed; minimum 2 plots required)											
PL1	36	52	65	78	30	74	22	0	1	3	369036E; 6374371N
PL2	38	66	45	78	10	74	12	0	1	5	369179E; 6374381N
Veg Zone 2 – Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter - Moderate/Good – Poor Broad Condition Class (4 plots completed; minimum 1 plot required)											
PL3	21	56	40	80	0	44	82	0	1	2	369716E; 6374292N
PL4	23	53	60	48	10	60	60	0	1	0	369519E; 6374286N
PL5	29	46	54	54	4	40	52	0	1	0	369172E; 6374522N
PL6	11	24	8	10	2	6	78	1	1	2	369143E; 6374366N
Veg Zone 3 (Plantings/Regeneration) - Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter – Low Condition Class (2 plots completed; minimum 1 plot required)											
MET HI REHAB 1	17	1.5	38	86	0	38	72	0	0.5	0	369484E; 6374502N
MET	26	4	14	2	0	42	62	0	1	0	369619E;

Plot ID #	Plant Species Richness	Native Over-storey Cover (%)	Native Mid Storey Cover (%)	Native Ground Cover – grasses (%)	Native Ground Cover – shrubs (%)	Native Ground Cover – other (%)	Exotic Plant Cover	# Tree Hollows	Overstorey Regeneration	Length Fallen Logs (metres)	AMG Grid Refs GDA94
REHAB 2											6374392N
Veg Zone 4 (Man-made ponds) - *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion. Moderate/Good-Medium Condition Class. (2 plots completed; minimum 1 plot required).											
MET HI POND 1	7	1	0	28	0	88	10	0	0	0	369481E; 6374466N
MET HI POND 2	9	1	0	20	0	90	14	0	0.33	0	369579E; 6374403N

2.7 Management Zones

Both vegetation zone 1 and 2 were stratified into 2 management zones, with one management zone representing complete vegetation clearing and the second representing partial clearing associated with the establishment of an asset protection zone (APZ). A single management zone was entered into the calculator for both vegetation zones 3 and 4 based on an assumed full clearing of these zones within the development footprint. For the site-based development, the Credit Calculator generates a post development attribute score for each Management Zone, derived from individual scores for 10 'Site Values' variables such as plant species richness, overstorey and mid storey cover, number of hollow bearing trees, etc. The post development attribute scores for each Management Zone were defaulted to '0' as the Credit Calculator assumes full clearing of the Management Zones. For the 2 Management Zones representing the proposed APZs (partial clearing), attribute scores for native plant species (richness) and native overstorey cover were manually increased from the default '0' to '1' with all other understorey attributes kept at the post development default value of 0 (as APZ under-scrubbing and ongoing mowing would be expected to remove the majority of the mid and ground strata).

The current (pre) and post development total site attribute score for the management zone representing complete clearing for vegetation zones 1, 3 and 4 are shown below in Table 9. No areas of vegetation zone 2 are proposed for complete removal (ie. contained within the project influence area) and thus no complete clearing management zones associated with vegetation zone 2 have been input into the BBAM calculator.

Table 9 Management Zone Attribute Scores (Complete Clearing)

Vegetation Zone	Management Zone Number	Management Zone Area (ha)	Current Site Value Attribute Score (out of 100 for all 10 site attributes)	Post Development Attribute Score
1 - Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter - Moderate/Good – Medium Broad Condition Class	1	0.09	46.01	0
3 – Native Plantings - Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter – Low Condition Class	1	2.53	32.29	0
4 – Man made ponds - *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion. Moderate/Good-Medium Condition Class.	1	0.17	60.47	0

The current and post development total site attribute score for the 2 management zones representing partial clearing associated with the asset protection zones (APZs) are shown below in Table 10.

Table 10 Management Zone Attribute Scores (APZ)

Management Zone Attribute Veg Zone 1 APZ = 1.96 ha Veg Zone 2 APZ = 0.4 ha	Current Attribute Score (0-3) – Veg Zone 1	Current Attribute Score (0-3) – Veg Zone 2	Post Development Attribute Score (0-3) - Veg Zones 1 and 2
Native Plant Species	2	2	1
Native over-storey cover	2	2	1
Native mid storey cover	2	2	0
Native ground cover (grasses)	2	3	0
Native ground cover (shrubs)	2	3	0
Native ground cover (other)	0	2	0
Exotic plant cover	2	0	0
Number of trees with hollows	0	1	0
Overstorey regeneration	3	3	0
Total length of fallen logs	1	0	0
Total Site Value Score	**46.01**	**46.70**	**7.29**

The establishment of APZs within both vegetation zones reveal a post development attribute score of 7.29 compared to a post development (complete clearing) score of 0. This will result in a modest reduction in the number of ecosystem credits required for offsetting relative to a full clearing scenario.

2.8 Threatened Species Survey Results

Section 8 of the credit calculator lists a total of 21 Threatened flora and fauna species that require targeted survey to confirm or discount their presence on the development site. In the absence of targeted surveys, an assumption can be made of the species presence on the site. None of the listed Threatened species were recorded as part of previous surveys on the development site and greater Metford triangle by (GHD 2013) and General Flora and Fauna (2014) nor by **pitt&sherry** (for Threatened flora species) during their recent biobank field surveys. As such, none of the listed Threatened species (species credit species) shown below in Table 11 were ticked as being impacted by the development.

The reader is referred to **Appendix A** for a full reproduction of the GHD (2013) and General Flora and Fauna (2014a; 2014b) reports detailing survey methods and results.

Table 11 Threatened Species Survey Results

Common Name	Scientific Name	Impacted by Development	ID Method (GHD 2013 and/or General Flora and Fauna 2014) supplemented by pitt&sherry biobank plots (July 2017) for Threatened flora species
Black-eyed Susan	*Tetratheca juncea*	No	Survey – Oct and Nov 2014 (Random meander transects)
Brush-tailed	*Phascogale*	No	Survey – Sept 2014 (Trapping)

Common Name	Scientific Name	Impacted by Development	ID Method (GHD 2013 and/or General Flora and Fauna 2014) supplemented by pitt&sherry biobank plots (July 2017) for Threatened flora species
Phascogale	*tapoatafa*		
Bynoe's Wattle	*Acacia bynoeana*	No	Survey – Sept/Oct/Nov 2014 (Random meander transects)
Common Planigale	*Planigale maculata*	No	Survey – Sept 2014 Small Mammal Trapping. Low likelihood of occurrence as no known records in the lower Hunter.
Eastern Pygmy-possum	*Cercartetus nanus*	No	Survey. Sept 2014 trapping. Low likelihood of occurrence based on absence of preferred Proteaceae-rich habitats and absence of local records.
Green and Golden Bell Frog	*Litoria aurea*	No	Survey – Dec 2014 survey. The abundance of Gambusia recorded in the man-made ponds likely precludes the use of the site for the species.
Green-thighed Frog	*Litoria brevipalmata*	No	Survey – Dec 2014 surveys.
Heath Wrinklewort	*Rutidosis heterogama*	No	Survey – Sept-Nov 2014 surveys (Random meander transects) supplemented with July 2107 pitt&sherry Metford Road transects.
Koala	*Phascolarctos cinereus*	No	Sept 2014 Survey – no current known records of Koala at Maitland – low likelihood of occurrence. No scats or Koalas recorded.
Leafless Tongue Orchid	*Cryptostylis hunteriana*	No	Nov/Dec 2014 Survey – Random meander and parallel line transects. This species was not listed by General Flora and Fauna (2014b) as being targeted in the spring and early summer searches but would no doubt have been recorded if present.
Netted Bottle Brush	*Callistemon linearifolius*	No	Sept-Nov 2014 Survey – Random meander transects. The author has mostly recorded this species in wetter forested habitats rather than LHSGIF habitats.
North Rothbury Persoonia	*Persoonia pauciflora*	No	Sept-Nov 2014 Survey – Random meander transects. Summer flowering but can be detected by vegetative material alone.
Pale-headed Snake	*Hoplocephalus bitorquatus*	No	Sept 2014 Survey – reptile searches.
Regent Honeyeater	*Anthochaera phrygia*	No	Aug 2013 and Sept 2014 Survey – diurnal bird surveys. Much more likely to occur in LHSGIF habitats at Cessock-Kurri Kurri where it is known as important habitat. Too little LHSGIF remnants in Maitland and Metford localities to attract this species, except on very rare occurrences.
Rough Doubletail	*Diuris praecox*	No	Aug 2013 and Sept 2014 Surveys – Random meander transects. The author has only recorded this species along managed (mown/slashed) transmission line easements and tracks rather than in forested habitats, thus low likelihood of occurrence on the development

Common Name	Scientific Name	Impacted by Development	ID Method (GHD 2013 and/or General Flora and Fauna 2014) supplemented by pitt&sherry biobank plots (July 2017) for Threatened flora species
			site.
Scant Pomaderris	*Pomaderris queenslandica*	No	Sept-Nov 2014 surveys – Random meander transects.
Singleton Mint Bush	*Prostanthera cineolifera*	No	Sept-Nov 2014 Surveys, although typically restricted to exposed sandstone ridges at Cessnock and Singleton – low likelihood of occurrence.
Slaty Red Gum	*Eucalyptus glaucina*	No	August 2013 and Sept 2014 surveys (Random meander transects) as well as Biobank plots in July 2017. The author has only recorded *E.tereticornis* on the site as part of the quarry plantings.
Small Snake Orchid	*Diuris pedunculata*	No	Sept-Oct 2014 Survey (Random meander transects). The author is not aware of any local records in the Maitland area.
Small-flower Grevillea	*Grevillea parviflora subsp. parviflora*	No	Sept-Oct 2014 Survey (Random meander transects). The author has recorded several subpopulations of this species across its range and would likely have detected this species on the development site if present by vegetative material only.
White-flowered Wax Plant	*Cynanchum elegans*	No	Sept-Nov 2014 Survey (Random meander transects). Low likelihood of occurrence in LHSGIF habitats.

Locations of Threatened fauna recorded on and adjoining Lot 7314 by General Flora and Fauna (2014) are shown in Figure 8.

No other species credit species listed in the Threatened Species Profile Database (TSPD) were generated by the BBAM calculator.

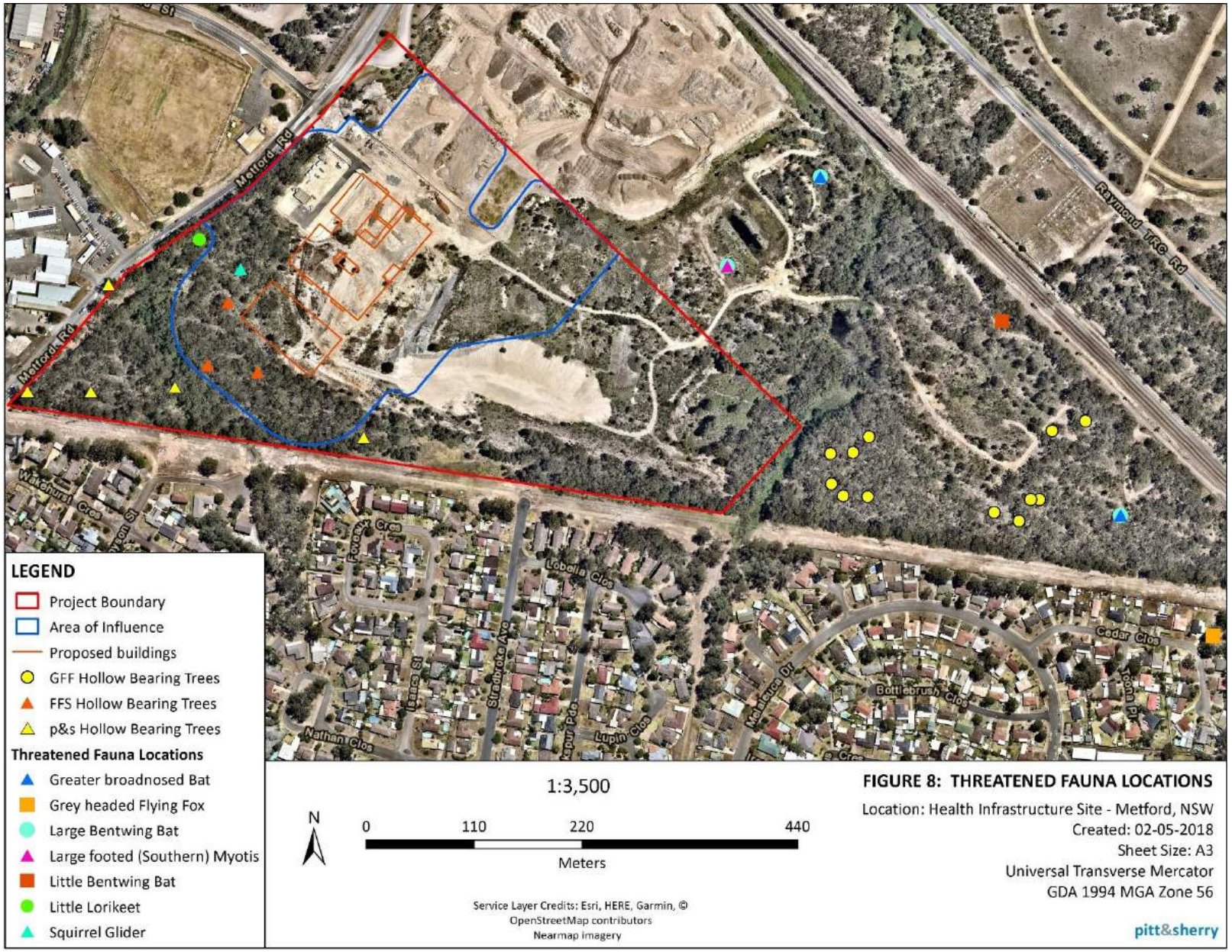

Figure 8 Threatened Fauna Locations

2.9 Biobank Assessment Results

2.9.1 Credit Report

The BBAM (2014) Credit Calculator was 'run' with the data input as described above and generated a Credit Profile for the development proposal for Ecosystem Credits as shown below in Table 12.

Table 12 Ecosystem Credit Requirements

Vegetation Zone	Management Zone	Management Zone Area (ha)	Final Ecosystem Credit requirement for Management Zone
1. Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (mod/good-medium)	MZ1a (full clearing)	0.09	3*
	MZ1b (APZ)	1.96	63*
2. Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (mod/good-poor)	MZ2b (APZ)	0.4	13*
3. Native Plantings - Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter – Low Condition Class	MZ3a (full clearing)	2.53	69
4. Man-made ponds - *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion. Moderate/Good-Medium Condition Class.	MZ4a (full clearing)	0.17	8
Total		**5.15**	**156****

Note:

***** The number of ecosystem credits for vegetation zones 1 and 2 appears as 80 in the Final Biobank Credit Report (refer Appendix E) as the BBAM rounds up the decimal value.

** The number of ecosystem credits for all four (4) vegetation zones appears as 157 in the Final Biobank Credit Report (refer Appendix E) as the BBAM rounds up the decimal value.

Table 12 reveals a total Ecosystem Credits requirement prescribed in the 'credits' tab in the BBAM calculator of 156 to offset the loss/modification of 5.15 hectares of LHSGIF and 'freshwater wetland' habitats on the proposed development site. It is noted the final biobank credit report generated by the BBAM calculator notes an ecosystem credit requirement of 157 as the BBAM rounds up the decimal value of the total area to be cleared.

No species credit species were deemed to be impacted by the proposal and thus no credit requirements were generated by the calculator.

The Final Biobank Credit Report generated by the Credit Calculator for the development site is provided as **Appendix E**.

3. Impact Assessment

3.1 Demonstration of Avoidance and Minimisation of Biodiversity Impacts

The development building footprint of the NMH has been sited within the predominantly cleared areas of Lot 7314 to avoid and minimise impacts to the LHSGIF remnant situated in the south-western sector of the subject lot. The retained bushland remnant would also serve as a visual buffer between the NMH and the existing residential suburb of Metford to the south of Lot 7314.

Limited clearing of the central portion of the LHSGIF south-western remnant would be required to accommodate an asset protection zone (APZ) for the NMH. Clearing for the APZ would comprise selective canopy removal to an open woodland/woodland structure (10-30% PFC) with no overlapping canopies, mid storey removal and partial groundcover removal. During APZ establishment advice would be sought from a fauna ecologist to identify key habitat trees (hollow-bearing trees) for retention, to minimise impacts on hollow-dependant fauna.

3.2 Impact Assessment

3.2.1 Subject Species and Communities

An assessment of direct and potential indirect impacts on flora and fauna species, populations and communities (with a particular focus on Threatened taxa and ecological communities listed under the BC Act) is provided below. The following are those species and ecological communities that have either been recorded or predicted to occur on Lot 7314 and that have the potential to be impacted upon by the proposal (and are thus defined as the suite of subject species and ecological communities for the purposes of the impact assessment):

EEC
Lower Hunter Spotted Gum Ironbark Forest of the Sydney Basin Bioregion

Fauna
Yellow bellied Sheathtail-bat
Eastern Freetial-bat
Eastern False Pipistrelle
Southern Myotis
Greater Broad-nosed Bat
Eastern Bent-wing Bat
Large eared Pied Bat
Little Bent-wing Bat
Eastern Cave Bat

Powerful Owl
Masked Owl
Sooty Owl
Barking Owl
Glossy Black Cockatoo
Gang-Gang Cockatoo
Little Lorikeet
Little Eagle
Varied Sitella
Dusky Woodswallow
Grey crowned Babbler
Speckled Warbler
Swift Parrot
Scarlet Robin
Squirrel Glider
Koala
Spotted tailed Quoll
Grey headed Flying Fox

Targeted flora surveys undertaken by GHD (2012), General Flora and Fauna (2014) as well as opportunistic traverses undertaken by the recent Biobank assessment (pitt&sherry July 2017) failed to record any Threatened flora species on Lot 7314. As such, it is considered that no Threatened flora species would be impacted by the current proposal and thus none have been included as subject species for the purposes of this impact assessment.

A subject species/likelihood of occurrence table is provided as **Appendix F.**

3.2.2 Direct Impacts

Direct Habitat Loss/Fragmentation

The proposal will result in the direct loss of native vegetation and fauna habitats listed in Table 13, shown below. Habitats proposed for direct removal or thinning have been calculated from an overlay of the proposed development onto vegetation mapping (refer Figure 2). The proposal will result in a direct total habitat loss of 4.98 hectares of LHSGIF in the south-western remnant of Lot 7314 as well as 0.17 hectares and man-made ponds (freshwater wetlands).

Table 13 Direct Vegetation/Habitat Loss

PCT Name and ID	Area Proposed to Be Completely Removed (hectares)	Area Proposed to Be Selectively Thinned and underscrubbed for APZ Establishment (hectares)
Spotted Gum-Red Ironbark-Grey Gum shrub-grass Open Forest of the Lower Hunter (HU806; PCT ID 1592) – Moderate/Good-medium	0.09	1.96
Spotted Gum-Red Ironbark-Grey Gum shrub-grass Open Forest of the Lower Hunter (HU806; PCT ID 1592) – Moderate/Good-Poor	Nil	0.4

PCT Name and ID	Area Proposed to Be Completely Removed (hectares)	Area Proposed to Be Selectively Thinned and underscrubbed for APZ Establishment (hectares)
Spotted Gum-Red Ironbark-Grey Gum shrub-grass Open Forest of the Lower Hunter (HU806; PCT ID 1592) – Low Condition (Plantings)	2.53	-
Phragmites and Typha orientalis coastal freshwater wetland (PCT ID 1071)	0.17	-

Habitat fragmentation has the potential to adversely impact upon native vegetation through a reduction in patch size. Fragmentation can reduce species richness and can alter interactions between species, such as pollination, seed dispersal and herbivory. A reduction in patch size can result in the loss of species that are area sensitive, meaning they demonstrate significant decreases in probability of occurrence as habitat area decreases because they have certain minimum physical area requirements that are not met in smaller patches. Some of these area sensitive species may also be 'edge sensitive' (I Mamott *pers. obs*.). The proposal would result in the removal of approximately 4.98 hectares of LHSGIF EEC from the south-western remnant on Lot 7314. The EEC on the subject site forms part of and is contiguous (albeit tenuously) with a larger LHSGIF remnant that extends to the east following the Ausgrid transmission line easement until its intersection with the main northern railway line (commonly referred to as the 'Metford triangle remnant'). The Metford triangle LHSGIF remnant within which the subject site forms a part of has an aerial extent of approximately 13 hectares. The proposed clearing associated with the NMH will contribute to further fragmentation of the greater Metford triangle LHSGIF EEC remnant. It is noted that the Metford triangle LHSGIF remnant has already been fragmented to the point where it is subject to significant edge effects (e.g. weed invasion) and is essentially 'hanging on' as an urban native ecosystem which has had its surrounding core habitat largely removed to construct the residential suburbs of the lower Hunter valley. Hence, whilst the proposal, *sensu stricto*, would not be expected to place a viable local population of the EEC at risk of extinction (the Metford triangle LHSGIF remnant is defined as the 'local viable population' for the purposes of this assessment), the proposal would be expected to increase its vulnerability to ongoing edge effects, stochastic events and a possible reduction in genetic diversity.

Given the extent of available forested habitat in the wider locality for the more mobile subject species that have relatively large foraging ranges (eg. owls, microbats, woodland birds, grey headed flying fox), the direct loss of 4.98 ha of dry sclerophyll forested habitat is not expected to result in a significant fauna impact. These highly mobile subject species would not be expected to be exclusively reliant on site habitats for their life cycle requirements and would be expected to utilise extensive forested tracts south of the site at Four Mile Creek (south-west of the New England Highway) as well as additional extensive tracts of bushland further south to Mt Sugarloaf Reserve and Awaba State Forest and west to Kurri Kurri. The site is considered to be at or close to the northern terminus of a local movement corridor for forest-reliant fauna given its position just south of the Tenambit wetlands and predominantly cleared Hunter valley floor. Whilst it is acknowledged that much of the forested lands (LHSGIF) has been cleared for the residential suburbs of Beresfield west to Maitland on the higher parts of the valley (ie. along the local ridge following the New England Highway), it is considered that adequate forested tracts remain for the highly mobile and wide ranging subject fauna species, including those that may be resident on the subject site.

A total of 4 hollow bearing trees were recorded opportunistically in the LHSGIF south-western remnant on Lot 7314 (plus one additional recorded in the adjoining Metford Rd corridor) as part of recent biobank plots undertaken by **pitt&sherry** (refer Figure 8). The recorded hollow bearing trees would be expected to provide potential shelter, denning, roosting and nesting habitat for a variety of fauna species, including the Squirrel Glider and Little Lorikeet (2 species recorded in the south-western remnant that would be subject

to limited clearing and thinning for APZ establishment). The proposal would not result in the removal of any of the recorded hollow bearing trees.

3.2.3 Indirect Impacts

A discussion of the potential for indirect impacts on biodiversity as a result of the proposed development is presented below.

Edge Effects

Murcia (1995) identifies both abiotic and biological edge effects. Abiotic edge effects are those that relate to changed environmental conditions within a bushland remnant and include changes to air moisture and temperature, solar radiation levels, soil moisture and temperature. Other abiotic edge effects include changes to wind speed and pattern. Biological edge effects involve changes in species abundance and distribution, either directly due to changed environmental conditions at the forest edge or indirectly through changes in species interactions such as pollination and seed dispersal (Murcia, 1995).

Whilst forest edges are sometimes associated with high species diversity (grassland/forest habitats), it is now understood that edge effects are detrimental to a wide range of flora and fauna (Murcia 1995; Laurance, 1991; Laurance, 2000). Laurance (1991) noted high levels of canopy damage up to 150 m and detectable levels of disturbance up to 500 m inside a remnant tropical rainforest in NE Queensland. Transmission ROW's typically allow more sunlight and wind into the near edge forested habitats (Laurance 1991). Laurance (1991) found that these effects penetrated up to 150 metres into a forested community from the easement edge, ultimately resulting in a denser shrub understorey and vine components. Murcia (1995) and Laurance (2000) also note that edge effects vary considerably in the distances of penetration, depending on such factors as the type of edge effect measured, the vegetation community being affected, the characteristics of the surrounding environment (e.g. pasture, cropland, urban) and the age of the remnant edge (time since edge was created). Whilst edge effects can be mitigated to some degree through restoration of edge areas, this is not a viable option for transmission easements.

The greater Metford triangle remnant has already been subject to significant edge effects from past and current development and remediation activities, with substantial areas of existing remnants exhibiting high exotic plant cover (e.g. Lantana) resulting in a markedly reduced native plant diversity particular in the midstorey. The proposed vegetation clearing for the enabling works compound would essentially result in one forest edge replacing another as the forest edge moves approximately 20 metres southward. Hence, the limited vegetation clearing proposed coupled with past disturbance and fragmentation would not be expected to result in an increase in edge to area ratios and as such would not be expected to result in a significant increase in edge effects to that already being experienced from an urban remnant that is already subject to extensive edge effects.

Habitat isolation and potential impact on faunal movement

It is likely that the New England Highway and main northern railway line form a local movement barrier for the Squirrel Glider in the immediate locality and that the species population is isolated both from smaller woodland stands surrounding the Tenambit and Morpeth wetlands to the north and from the larger tracts of forested lands to the south of the New England Highway. The Squirrel Glider was recorded in the LHSGIF remnant in the far south-western corner of the Metford triangle and as such is likely reliant on habitats within the Metford triangle for its life cycle requirements (i.e. foraging, denning, movement) given the likely isolation of its meta-population in the lower Hunter valley.

The limited vegetation clearing associated with the Early Works compound and thinning associated with APZ establishment would not be expected to contribute to further habitat isolation nor movement barrier impacts for less mobile subject species such as the Squirrel Glider. The Squirrel Glider would benefit, however, from supplementary native plantings along the central southern boundary of Lot 7314 to increase

tree and mid storey cover to facilitate greater movement in this area of the site. This recommendation is discussed further in Section 4.4 of the BAR.

Potential injury to fauna during clearing

The vegetation clearing and thinning works have the potential to impact upon fauna that may be utilising the habitats within proposed clearing areas at the time of the clearing. Of particular concern, would be the potential for temporary displacement and/or injury caused to fauna occupying nests, hollow bearing trees and hollow logs.

A number of mitigation measures have been formulated for the proposal to reduce the potential for injury to fauna during the clearing activity. These measures are detailed in Section 4 and include pre-clearing surveys, clearing supervision, and particular tree felling methods.

Potential importation of pathogens

There is the potential for the importation of soil borne pathogens such as *Phytophthora cinnamomi* spores into the south-western remnant of Lot 7314 as a consequence of clearing activity which can subsequently spread into adjoining habitats. Of particular concern, would be the use of any vehicles that have been utilised in other areas where pest species or pathogens are known to occur. Vehicles and equipment (e.g. chainsaws) used for the clearing activity would therefore be subject to cleaning/disinfection in accordance with a hygiene protocol to be prepared as part of a post approval Biodiversity Management Plan.

Altered Hydrology

Altered local hydrology regimes can impact on the species composition and health of various ecosystems that rely on surface or groundwater for part of their life cycle requirements. Stormwater management is discussed in detail in the EIS and notes that the proposal would meet Council's post development pollutant levels through a series of onsite treatments (e.g. filters, basins) prior to discharge. It is noted that the stormwater modelling undertaken for the proposal by Wood and Grieves (July 2017) for the 2 site catchments shows a 45-66% reduction in post development pollutant loads for Total Nitrogen (TN) and Total Phosphorous (TP) prior to discharge.

Changes in groundwater chemistry and water table levels (i.e. drawdown or drawup) can have an impact on species composition and the health of groundwater dependent ecosystems, such as the creekline vegetation and Hunter Lowland Redgum Woodland identified on the greater Metford triangle remnants outside Lot 7314.

Noise, Light Spill and Vibration

Potential indirect impacts on retained fauna (dry sclerophyll) habitats on Lot 7314 during construction activity include daytime noise and vibration and nigh time light spill. Noise, vibration and light spill can have an impact on a suite of protected and Threatened fauna such as roosting microbats and owls and denning arboreals such as the Squirrel Glider (recorded on Lot 7314). The subject site lies within an urban area of the lower Hunter valley and it is considered that the assemblage of resident and transient fauna utilising site habitats would be habitualised to typical urban daytime ambient noise and vibration levels from Metford Road, the industrial area on the western side of Metford Rd (south of Fieldsend oval) and the long-term mining activity and more recent remediation activity that has been undertaken on the site.

Measures are recommended below in Section 3.3 to limit light spill onto retained LHSGIF habitats on Lot 7314.

Human Intrusion

Human intrusion into retained bushland remnants can lead to illegal rubbish dumping, dispersal of pests and pathogens, plant trampling/disturbance and wildlife disturbance. The Metford triangle has been subject to access restrictions through 2 metres tall wire mesh fencing around the perimeter of the site

along with the barrier of the rail line along its northern boundary. Recommendations are made in section 4 of the report to limit public access to the retained bushland habitats on Lot 7314.

3.2.4 EPBC Assessment

An EPBC Assessment was undertaken by General Flora and Fauna (2014) for a previous proposal on the subject site. An updated EPBC assessment for the current proposal is provided below.

The assessment has been undertaken in accordance with the Commonwealth Significant Impact Assessment Guidelines (DoE 2013) which lists a suite of significant impact criteria to assist in determining whether there is likely to be a significant impact on Matters Of National Environmental Significance (MNES) and thus whether a referral to the Commonwealth DoEE is required.

An EPBC Act Protected Matters report was generated using the EPBC Protected Matters Search Tool on the Commonwealth Department of the Environment and Energy website (http://www.environment.gov.au/webgis-framework/apps/pmst/pmst.jsf) based on a 10km buffer search centered on Lot 7314.

The Protected Matters report (2017) yielded the following search results listed in Table 14.

Table 14 EPBC Protected Matters Search Tool Results

MNES	Number of MNES identified within a 10km buffer from subject site
World Heritage Properties	None
National Heritage Places	None
Wetlands of International Importance	1
Great Barrier Reef Marine Park	None
Commonwealth Marine Area	None
Listed Threatened Ecological Communities	3
Listed Threatened Species	62
Listed Migratory Species	48

Based on the search results, the proposal would not impact upon any world heritage properties, national heritage places, Commonwealth marine areas nor the Great Barrier Reef Marine Park given their absence in the vicinity of the subject site. Remaining MNES are address below.

Wetland of International Importance
An action is likely to have a significant impact on the ecological character of a declared Ramsar wetland if there is a real chance or possibility that it will result in:

- areas of the wetland being destroyed or substantially modified;
- a substantial and measurable change in the hydrological regime of the wetland, for example;
- substantial change to the volume, timing, duration, and frequency of ground and surface water flows to and within the wetland;
- the habitat or lifecycle of native species, including invertebrate fauna and fish species, dependent upon the wetland being seriously affected;

- a substantial and measurable change in the water quality of the wetland – for example, a substantial change in the level of salinity, pollutants or nutrients in the wetland, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity or human health, or
- an invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland.

The Hunter Estuary Wetlands (Hunter Wetlands National Park), a RAMSAR wetland, is located approximately 10km south-east (downstream) from the subject site. With appropriate stormwater management, the proposal is unlikely to have a significant impact on the RAMSAR wetland based on the criteria noted above.

Threatened Ecological Communities (TECs)
The Protected Matters report lists the following three TECs recorded within 10km from the subject site:

1. Central Hunter Valley eucalypt forest and woodland (critically endangered).
2. Lowland rainforest of Subtropical Australia.
3. White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland.

None of the 3 TECs have been recorded on Lot 7314 and thus would not be impacted as a result of the proposal. It is noted that there is some floristic overlap between Lower Hunter Spotted Gum Ironbark Forest (LHSGIF) recorded on Lot 7314 and Central Hunter valley eucalypt forest and woodland (CHVEFW) as both have their distributional limits at Maitland. It is our opinion that the subject site supports LHSGIF rather than CHVEFW given the absence of *Eucalyptus molucanna*, the general dominance of *Eucalyptus fibrosa* over *Eucalyptus crebra* and the co-dominance of *Eucalyptus punctata* x *canaliculata*.

Although not listed in the Protected Matters Search report, the man made stormwater ponds on the site are not considered to represent the Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains Critically Endangered listing under the EPBC based on key diagnostic characteristics. The listing does not capture 'permanently inundated' wetlands dominated by permanent water aquatics such as Typha and Eleocharis spp. (as occurring on the site).

Listed Threatened Species
An action is likely to have a significant impact on a listed Threatened species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of a population
- reduce the area of occupancy of the species
- fragment an existing population into two or more populations
- adversely affect habitat critical to the survival of a species
- disrupt the breeding cycle of a population
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species habitat
- introduce disease that may cause the species to decline
- interfere with the recovery of the species.

Of the 62 listed Threatened species recorded within a 10km buffer distance from the subject site (excluding migratory wetland species), a total of 4 species have been recorded or are considered as possible occurrences on Lot 7314, these being:

1. Spotted-tail Quoll
2. Grey headed Flying Fox
3. Swift Parrot
4. Regent Honeyeater.

All 4 species are wide ranging and would be unlikely to be exclusively reliant on site habitats for their life cycle requirements. The proposal would result in a small loss of potential foraging habitat for these 4 taxa.

A fifth listed Threatened species, the Green and Golden Bell Frog, has not been recorded on the site despite targeted searches for it in 2014. The presence of *Gambusia* in the man-made ponds on Lot 7314 is thought to preclude the use of the site by the species.

A number of listed Threatened flora species considered as possible occurrences on the site (eg. *Acacia bynoeana, Grevillea parviflora subsp parviflora, Rutidosis heterogama, Tetratheca juncea, Cryprostylis hunteriana*) have been targeted in previous site investigations (GHD 2012; General Flora and Fauna 2014) and have not been detected. As such, these taxa are not considered to be present on the site and are thus unlikely to be impacted by the proposal.

Listed Migratory Species
An action is likely to have a significant impact on a **migratory species** if there is a real chance or possibility that it will:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species
- result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behavior) of an ecologically significant proportion of the population of a migratory species.

Of the 48 listed Migratory species recorded within a 10km buffer distance from the subject site, a total of 15 migratory wetland species are considered as possible occurrences on Lot 7314 within the small man-made ponds, these being:

Common Sandpiper
Sharp-tailed Sandpiper
Curlew Sandpiper
Red-necked Stint
Great Knot
Double banded Plover
Greater Sand Plover
Lesser Sand Plover
Latham's Snipe
Broad billed Sandpiper
Bar tailed Godwit
Eastern Curlew
Osprey

Pacific Golden Plover
Terek Sandpiper

Whilst limited potential habitat exists on Lot 7314 for the above listed species, it is noted that much more expansive habitats exist within the Tenambit wetlands to the north in addition to the ephemeral and semi-permanent floodplain wetlands of the lower Hunter valley which would be expected to provide higher quality habitat for these wetland taxa (than that afforded by the small man-made ponds on and adjoining Lot 7314).

The proposal will result in the removal of approximately 4.98 hectares of Spotted Gum Ironbark Dry Sclerophyll Forest, 2.53 ha of Acacia plantings and 0.17 hectares of man-made ponds within the project influence area. The proposal would not be expected to result in the removal of roosting, denning and breeding habitat for the hollow obligates recorded on Lot 7314 given the retention of identified hollow bearing trees in the study area. The proposal would not be expected to fragment the greater Metford triangle bushland remnant with which it forms a part of to the extent that it will compromise its long-term viability, although its further fragmentation likely would be expected to contribute to its ongoing vulnerability to edge effects, stochastic extinction events and a possible reduction in genetic diversity.

None of the subject species would be expected to be exclusively reliant on site habitats and all are considered relatively wide ranging species, none of which are at their limit of distribution at Metford. The retention of the HBTs recorded in the study area (and those recorded throughout the Metford triangle from previous ecology surveys) as well as the minimisation of tree clearing associated with the APZ establishment would be expected to maintain movement corridors for the subject species throughout the greater Metford triangle remnant.

Based on the above discussion, the Proposal is not likely to result in a significant impact on the relevant subject species and thus a referral to the Commonwealth Department of Environment and Energy (DoEE) is not assessed as being required based on our interpretation of the guidelines. Notwithstanding the above, the Proponent may wish to refer the Proposal to DoEE to obtain legal certainty.

4. Mitigation Measures

A suite of measures is proposed below which aim to minimise potential adverse impacts on biodiversity.

4.1 Biodiversity Management Plan

A Biodiversity Management Plan (BMP) is to be incorporated in the project Construction Environmental Management Plan (CEMP) to include detail of the mitigation measures outlined below. The BMP would aim to reduce the potential impacts of the proposal on biodiversity through minimising the extent of clearing, maintaining key habitat and also reducing the potential injury to fauna during and after the clearing works. The BMP will also include a map showing specific areas where particular measures are to be implemented.

4.2 Clearing Protocol

The following protocol would be undertaken as part of the clearing activities:

1. Clearing boundaries shall be pegged out by a registered surveyor and suitably demarcated (eg metal stake and high vis plastic mesh fencing) prior to vegetation clearing activity.
2. A clearing protocol for the APZ to be prepared in consultation with a bushfire consultant and fauna ecologist to identify trees proposed for retention and clearing. The protocol would aim to achieve the APZ requirements while maximising retention of fauna habitat trees.
3. Each tree proposed for clearing not identified on the Tree Removal Plan associated with APZ establishment must be appropriately tagged for clearing through the use of surveyors flagging tape and spray paint. Trees not marked must not be removed.

4. All contractors conducting clearing, earth works or construction activities within Lot 7314 must be informed of the ecological value of the retained forested remnants and particularly the restrictions to the clearing of vegetation outside the 'exclusion fencing'. A construction protocol to be prepared requiring all earthworks, machinery and personnel be strictly controlled and be restricted to the development footprint only with the exception of the clearing Contractor. No storage of materials, vehicle parking or other disturbance would be undertaken outside the exclusion fencing into retained bushland habitats.
5. A site induction must be undertaken so as to clearly inform personnel undertaking clearing operations the relevance of any marked items (e.g. HBTs requiring ecological supervision, clearing boundaries) and identify their responsibilities. A site induction will need to be signed by all relevant personnel involved with the clearing operations, noting they have understood ecological conduct requirements.
6. Trees would be felled away from the retained forested remnants back into the proposed development footprint. APZ clearing would employ suitable techniques to avoid damage to retained trees and their rootzones.

4.3 Erosion and Sedimentation Control

Standard erosion and sedimentation control devices (*e.g.* silt fences, hay bales) shall be installed downslope from clearing operations along development/retained forested habitat interfaces to minimise sedimentation of the 2 drainage lines within and adjoining Lot 7314. As part of APZ establishment, consideration should also be given to retaining as much groundcover as possible to minimise soil erosion and sedimentation.

4.4 Reducing the potential impact to fauna during clearing operations and post construction

The following measures have been formulated to reduce the potential impact to fauna that may be inhabiting trees within or adjoining the proposed clearing area at the time of the vegetation clearing operations. In addition, measures have been formulated to reduce the potential impact upon fauna utilising the habitats within the study area post construction.

Ecological clearing supervision

Should any hollow bearing trees be identified during pre-clearing surveys and targeted for removal, the removal of these must be undertaken with the presence of a qualified ecologist and the cavities of any hollow bearing trees will need to be checked for inhabiting fauna upon felling. Any injured fauna should be captured where possible and taken to the local wildlife carer. Once rehabilitation has been achieved (if possible), the individual will be released into retained habitats adjoining the capture site, and if required, into shelter sites appropriate for that species (*i.e.* nest boxes).

The relevance of the marked HBTs and requirements for ecological clearing supervision must be communicated to the supervisor responsible for the clearing contractors.

Pre-clearing surveys

Where practicable restrict vegetation clearing activity to within the period late February to end of May, this being outside the main breeding periods for hollow dependant fauna such as microbats. If, however, restricting the clearing to these times is not found to be practical from a construction perspective, then ecological pre-clearing surveys would be undertaken prior to the commencement of the clearing. These surveys will be aimed at targeting particular Threatened species known or potentially occurring in the area and attempt to identify critical sites for these species. If critical habitat sites are located, appropriate impact mitigation measures will be undertaken according to the type of site/feature and species concerned. The pre-clearing surveys would entail searches for nest sites, maternal roosting sites for microchiropteran bats, and breeding sites for large forest birds such as Owls and the Glossy Black-Cockatoo. If any nest sites of the

larger sized birds such as the Square-tailed Kite and other raptors, Powerful Owl, and Masked Owl are located within 50 metres of the clearing area, all works should immediately cease, the nest monitored and reported to OEH. Clearing should then only recommence after the fledging of the young.

A combined stagwatching and Anabat survey would be conducted on any hollow bearing trees requiring removal to identify any potential Microchiropteran roost sites occurring within the clearing area, for a period of two (2) nights per tree, prior to clearing. If a roost is located within an area to be cleared, it will be removed and resited if possible. If the site is suspected to be a maternity colony, further investigations will be undertaken using an infra-red lipstick camera and video system. If the site is then found to be a maternity colony, clearing will cease and monitoring of the site will be initiated. The clearing would only recommence only after the young or colony has vacated the site.

Nest box program

Should pre-clearing surveys identify any hollow bearing trees targeted for removal, and the hollow is occupied or there is evidence of past occupation, they shall be replaced through a compensatory nest box program in retained bushland habitats on Lot 7314. Natural tree hollows shall be replaced by nest boxes sourced from a reputable supplier (e.g. hollow log homes) with a 1:1 ratio and shall include boxes of suitable entrance diameters to those being replaced (i.e. targeting microbats, owls or arboreals such as the Squirrel Glider, Little Lorikeet). Nest boxes shall be installed in retained habitats by a suitable qualified and experienced fauna ecologist and shall be monitored annually (spring) for usage, for a period of 3 years post installation.

Supplementary Plantings

To facilitate greater movement for the Squirrel Glider between stands of bushland on Lot 7314, it is recommended that a 0.4 hectare predominantly cleared area along the southern boundary of Lot 7314 be planted out with advanced eucalypt and Acacia small tree/shrub tubestock sourced from a commercial nursery. Species to be planted out should be restricted to those detailed in the LHSGIF community profile (**Appendix C**). Seed may need to be sourced from the site and used to propagate tubestock should commercial tubestock not be readily available. Eucalypt tubestock should be planted at approximately 5 metre spacings which equate to approx. 160 tubes. Acacia tubestock should be planted at approximately 2 metre spacings which equate to approx. 1000 tubes. Tubestock propagation, planting design, methodology and maintenance shall be detailed in the Biodiversity Sub-Plan to be prepared for the project post approval.

The area within Lot 7314 proposed for supplementary plantings is shown in Figure 9.

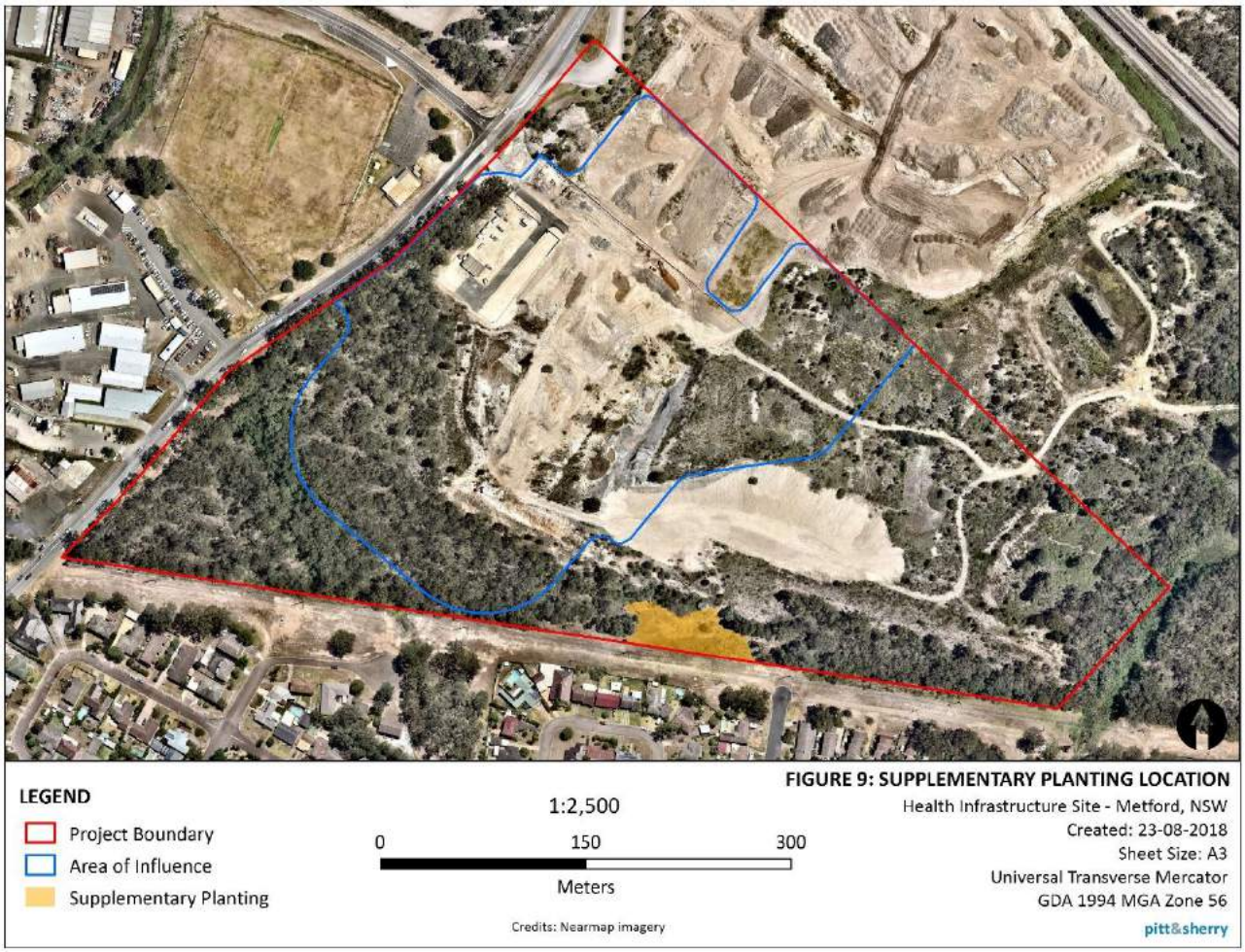

Figure 9 Supplementary Plantings Location

Fencing of Retained Bushland on Lot 7314

It is noted that the LHSGIF remnant on Lot 7314 is subject to existing chain metal fencing along Metford Road and along the southern boundary of the greater Metford triangle (running parallel with the powerline easement). It is recommended that this boundary fencing be supplemented with the installation of suitable fencing along the internal perimeter of the LGSGIF remnant on Lot 7314 (and outer edge of the APZ) to restrict vehicle access to retained bushland habitats.

Light Spill

It is recommended that night lighting be installed as far from the retained bushland habitats on Lot 7314 as possible and that such lighting be directed away from such habitats to minimise nocturnal light spill.

5. Biodiversity Offset Strategy (BOS)

Health Infrastructure (HI) are committed to meeting its offset obligations outlined in Section 2 of the BAR through one or more of the following options:

1. Payment into the Biodiversity Conservation Fund (BCF) of an amount determined in accordance with the BAM biodiversity offset payment calculator;
2. Purchase and retirement of open market available ecosystem and species credits in accordance with the Biodiversity Conservation Regulation 2016 offset and offset variation rules; and
3. Establishment of a Biodiversity Stewardship Site.

Each of these 3 options is discussed below. Identification of the final preferred offset method would be determined as part of detailed design.

5.1 Payment into BCF

The ecosystem and species credit requirements generated by the BBAM calculator presented in Section 2.9 of the BAR were input into the online biodiversity offset payment calculator (BOPC) (https://www.lmbc.nsw.gov.au/offsetpaycalc) to generate credit prices and total payment amounts necessary to offset the credit requirements for the proposal. BOPC credit prices generated for the proposal are shown below in Table 15

Table 15 BOPC Credit Prices (Ecosystem Credits)

PCT common name	Baseline price per credit ($)	Dynamic coefficient	Market coefficient	Risk premium (%)	Admin cost($)	Method adjustment factor	Price per credit ($)	No. Ecosystem Credits	Final credits price ($)
1592 – Spotted Gum-Red ironbark-Grey Gum shrub grass open forest of the lower Hunter	2215.81	0.8402444	1.13119203	21.64	20.00	1	2460.12	149.05	366,681.43
1071 – *Phragmites australis Typha orientalis* coastal freshwater wetland of Sydney Basin	5,000.00	0.8402444	1.13119203	21.64	20.00	1	4854.88	8	38,839.04
Sub-total									$405,520.47
GST									$40,552.05
Total									**$446,072.52**

BOPC results presented above in Table 15 reveal a total credit payment of **$446,072.52** (GST inclusive) for the proposal.

5.2 Open Market Credit Purchase

5.2.1 Ecosystem Credits

One of the options Health Infrastructure is pursuing to meet their offset obligations is purchasing suitable biodiversity credits that may be available on the open credit market. To this end, a search of the biobank public credit registers was undertaken in February 2018 to determine the availability of ecosystem credits for a total of 11 PCTs that the BBAM calculator has determined as being suitable for offsetting PCT 1592. Results of the register search are shown below in Table 16.

Table 16 Credit Register Search Results

PCT Name and (ID)	Potential Available Credits	Credit Transaction and Sales Data	Biobank EOI
Spotted Gum-Red Ironbark-Grey Gum shrub-grass open forest of the Lower Hunter (1592)	585 ecosystem credits issued to Stannic Securities.	Nil records	Nil records
Melaleuca decora low forest of the central Hunter Valley, Sydney Basin Bioregion (922)	Nil records	Nil records	Nil records
Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast (1178)	Nil records	Nil records	Nil records
Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast (1588)	Nil records	Nil records	Nil records
Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (1590)	Nil records	Nil records	Nil records
Red Ironbark - Spotted Gum - Prickly-leaved Paperbark shrubby open forest of the Lower Hunter (1593)	Nil records	Nil records	Nil records
Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter (1600)	Nil records	Nil records	Nil records
Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter (1601)	Nil records	Nil records	Nil records
Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter (1602)	Nil records	Nil records	Nil records
Grey Box - Grey Gum - Rough-barked Apple - Blakely's Red Gum grassy open forest of the central Hunter (1608)	Nil records	Nil records	Nil records

Results from Table 16 reveal the availability of 585 ecosystem credits of PCT 1592 by Stannic Securities. **pitt&sherry** has held initial discussions with Erik Stanner (Stanner Securities) who indicated approximately 400 of the 585 credits for PCT 1592 are still available. Further negotiation between HI and Stannic Securities would be required if this option were adopted.

No ecosystem credits were available for any of the other 10 suitable offset PCTs at the time of the register search.

5.3 Establishment of Stewardship Site

The third option available to HI is the purchase of land with suitable PCTs to establish a stewardship site. The proposed removal of 4.98 hectares of LHSGIF habitat would likely require approximately 15-20 hectares of forested land, based on a typical biobank/stewardship site generating somewhere between 6-8 credits per hectare. It is likely that LHSGIF remnants being retained within the greater Metford triangle would generate sufficient ecosystem and species credits to offset the proposal, although a BBAM assessment on these lands would be required to confirm this. Approximately 1 ha of biobanked freshwater wetlands would be needed to satisfy the 8 credits required for this PCT.

A desktop GIS assessment would be required to identify a 'short-list' of potential stewardship properties that support 1 or more of the 11 PCTs deemed by the BBAM calculator as being suitable for offsetting the proposal.

No initial investigations have been undertaken to pursue this option to date.

6. Conclusion

This Biodiversity Assessment Report (BAR) was prepared in accordance with the Framework for Biodiversity Assessment to accompany an Environmental Impact Statement (EIS) for the New Maitland Hospital (NMH) project.

Previous ecological investigations of the site by GHD (2013) and General Flora and Fauna (2014) were relied upon to prepare this BAR. Additional biodiversity offsetting work (10 Biobank plots/transects) was undertaken in July 2017 across the NMH study area by **pitt&sherry** to assist with the completion of the Biobank assessment and to validate previous vegetation mapping.

In 2018 a review of this BAR was undertaken by Michael Murray of Forest Fauna Surveys. The basis of the review was to consider the adequacy of previous assessments specific to threatened fauna, and whether the proposed action will impact upon threatened fauna. This report also provided recommendations to assist with fauna management and impact minimisation which have been incorporated within the BAR.

The Site has been heavily disturbed in associated with historical extractive industry and brick making activities that have occurred across the Metford Triangle. It contains a mosaic of cleared land; artificial wetlands and stormwater ponds; and native rehabilitation plantings; as well areas of native vegetation described as Lower Hunter Spotted Gum-Ironbark Forest (LHSGIF) in the southwestern and southeastern parts of the Site. The LHSGIF remnant is considered an Endangered Ecological Community (EEC) under the Biodiversity Conservation Act 2016 (BC Act) and is predicted to provide potential habitat for a variety of threatened fauna.

Targeted searches revealed that none of the predicted threatened flora or fauna were recorded on the Site.

The proposed development will result in the clearing of part of the LHSGIF remnant forest, either for the hospital building footprint or maintenance of an Asset Protection Zone (APZ). One threatened fauna species, the Squirrel Glider, was recorded within the development impact area, and one bird species (Little Lorikeet) and several microbat species are likely to forage within the remnant forest or adjacent open space. The species considered most likely to be impacted is the Squirrel Glider.

A site based, major project development scenario was run through the current version of the Biobank Credit Calculator on 24 August 2018. This resulted in a requirement for 157 ecosystem credits being required to offset the impact of the development.

Mitigation measures are recommended to minimise the potential impacts of the development and include preparation of a Biodiversity Management Plan, development of clearing protocols, implanting pre-clearing surveys for threatened flora and fauna, and other impact mitigation measures during vegetation clearing. Supplementary planting is recommended in a cleared area along the southern boundary of the Site, to facilitate greater movement for the Squirrel Glider between stands of bushland on Lot 7314.

A Biodiversity Offset Strategy was prepared that outlines several options available to HI to meet their obligations based on the outcome of the Biobank Credit Calculator. Options include:

- Payment into the Biodiversity Conservation Fund (BCF) of an amount determined in accordance with the BAM biodiversity offset payment calculator;
- Purchase and retirement of open market available ecosystem and species credits in accordance with the Biodiversity Conservation Regulation 2016 offset and offset variation rules; and
- Establishment of a Biodiversity Stewardship Site.

The final offset method would be determined at a later time and confirmed as part of the Stage 2 application.

Appendix A

Previous Ecological Investigations – GHD (2013) and General Flora and Fauna (2014a; 2014b)

APP Corporation

Metford Quarry and Brickworks Site

Flora and Fauna Assessment

Rev 0

September 2013

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Appendix A – Likelihood of occurrence
Appendix B – NSW Wildlife Atlas search results (threatened species)
Appendix C Protected matters search tool results
Appendix D Species recorded on site

1. Introduction

1.1 Background

GHD was engaged by APP in August 2013 to undertake a flora and fauna assessment of the site of the former Metford Quarry and Brickworks (hereafter 'the site'). CSR currently has a lease over the site and is looking to hand the land back to the Crown. Options for post-mining use of the land are being explored. Information on the terrestrial and aquatic flora and fauna at the site is required to contribute to this decision making process.

1.2 Site description

The site is approximately 63 hectares (ha) in area and is bordered by Metford Road to the west, railway to the north and east, and residential areas to the south (Figure 1-1). The locality surrounding the site contains a mix of residential, commercial, rural and light industrial land uses. Native vegetation has been extensively cleared.

The topography of the site features low-lying poorly drained ponds supporting wetlands and a number of small ephemeral wetlands. Several permanent and ephemeral drainage lines link the wetlands. One named drainage line, Two Mile Creek, meanders south to north through the western portion of the study are. The land west of Metford Road contains a large waterbody, with surrounding wetland and forested areas. To the East of Metford Road forested areas of the sites contain predominantly gentle slopes with several rocky outcrops that are traversed by numerous informal access tracks. There are large expanses of cleared land across the western and central sections of the site. These areas contain a mix of hardstand (i.e. concrete and bitumen), disused buildings, ancillary infrastructure, and tracks and roads, as well as some areas of steep terraces and ridges, evidently from previous quarrying activities.

The Newcastle Soil Landscapes Series (Matthei 1995) maps the majority of the site as the Beresfield ('be') soil landscape, which consists of undulating low hills and rises on Permian sediments. There is also a small area surrounding Two Mile Creek that is mapped as Cockle Creek (cc) soil landscape, which consists of narrow floodplains and alluvial flats (Matthei 1995). The Beresfield soil landscapes are composed of Permian deposits of shale mudstone and siltstone on moderately deep (>120cm), moderately well to imperfectly drained yellow and brown podzolic soils. The Cockle Creek soil landscapes are characterised by deep Quaternary alluvial sediments that form deep (>200 cm) and poorly drained yellow and brown podzolic soils (Matthei, 1995).

1.3 Purpose of this report

The primary aim of this flora and fauna assessment is to identify the key biodiversity values of the site. The specific objectives of the assessment are as follows:

- Provide information on the terrestrial and aquatic flora and fauna within the study area
- Identify vegetation communities occurring within the study area
- Identify fauna habitat types present within the study area
- Identify the presence or likely occurrence of threatened species, populations and ecological communities and their habitats listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act)

- Identify the presence or likely occurrence of matters of national environmental significance (MNES) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and.
- Identify the presence or likely occurrence of Aquatic Species listed under the *Fisheries Management Act 1994* (FM Act).

1.4 Definitions

For the purpose of this report the following definitions apply:

- 'Study area'- the area that was assessed during this investigation as shown on Figure 1-1.
- 'Locality' - the area within a 10 km radius of the study area.
- 'Region' - the Sydney bioregion (Thackway and Cresswell 1995).

Paper Size A4

0 70 140 280 420 560

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Site Boundary
- Cadastre
- Waterbody
- Watercourse

Metford Quarry and Brickworks Site
Flora and Fauna Assessment

Job Number 22-16974
Revision 0
Date 06 Sep 2013

Site Location

Figure 1-1

G:\22\16974\GIS\Maps\Deliverables\Flora_Fauna_Assessment\22_16974_FFA001_SiteLocation_0.mxd

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com.au

Data source: LPI: DCDB & DTDB - 2012; ESRI: Aerial Imagery 2013. Created by: fmackay, tmorton

2. Methodology

2.1 Literature review

A desktop review was undertaken to help determine the conservation significance of the site and to identify threatened species, populations and ecological communities listed under the TSC Act (i.e. threatened 'biota') and MNES listed under the EPBC Act that could potentially occur at the site. The following documentation was reviewed prior to the field investigations:

- Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) Protected Matters Search Tool for relevant MNES listed under the EPBC Act (August 2013 – within a drawn polygon centred on the site, buffered at 10km).
- The NSW Office of Environment and Heritage (OEH) Wildlife Atlas database (OEH, 2013a) for threatened species listed under the TSC Act (within a 10km radius of the site).
- OEH (2013b) online threatened biodiversity profiles for endangered ecological communities (EECs) known to occur within the locality (Hunter-Central Rivers Catchment Management Area).
- Lower Hunter Central Coast Regional Environmental Management Strategy (LHCCREMS) vegetation mapping (2003).
- Department of Primary Industries Threatened and Protected Species Records Viewer for threatened species listed on the FM Act previously recorded within the catchment (Hunter-Central Rivers Catchment).

2.2 Field surveys

Field surveys were conducted by two teams of two ecologists. One team of two ecologists undertook fauna surveys on the 19-20 August 2013 and one team of two ecologists undertook flora surveys on 20-21 August 2013 within the site boundary shown on Figure 1-1. The purpose of this assessment was to survey flora and fauna that occur on the site, and determine what threatened species may occur on site. Methods utilised during the assessment are described below.

2.2.1 Flora survey and vegetation mapping

A combination of quadrats and targeted searches for threatened species was used to survey the study area and to verify vegetation communities, in particular EECs. Detailed descriptions of survey techniques are outlined below.

The field survey included the following techniques:

- Identification and mapping of broad vegetation types occurring at the site. Vegetation types were identified and named according to LHCCREMS (2003). Boundaries of vegetation types were recorded using a hand held GPS unit.
- Assessment of the floristics of each vegetation type using 20 X 20 metre quadrats. Within each quadrat all flora species, exotic and native, were recorded. The condition of vegetation was assessed based on the presence of exotic species, degree of site disturbance, the diversity of native species within the canopy, midstorey and ground cover, and the general health of the vegetation. Plant specimens that could not be identified rapidly in the field were collected and subsequently identified using the *Flora of NSW* (Harden 1990-1993). The location of field survey quadrats were recorded with a hand held GPS unit and are shown in Figure 3-3.

- Targeted surveys for rare or threatened flora species were undertaken throughout the study area in areas identified as containing suitable habitat for species previously recorded within the locality. The targeted flora surveys included random meander transects as described by Cropper (1993).
- The structure and floristics of vegetation types were compared to those ecological communities listed under the TSC Act and EPBC Act to determine if they were characteristic of a threatened ecological community.
- Opportunistic and incidental observations of flora species not recorded during quadrat surveys were noted.

2.2.2 Fauna survey

Fauna habitat assessment

An assessment of potential threatened fauna habitat was made across the site. The locations of significant habitat features, such as habitat trees and logs, were captured with a handheld GPS unit and photographed where appropriate. For the purpose of this assessment 'habitat tree' was defined as a tree with one or more of the following characteristics: diameter at breast height (DBH) >100cm; visible hollows; cracks, fissures or shedding bark that may provide roost sites; large concentrations of blossoms or fruit; visible nest(s) or roost(s); and/or visible evidence of fauna occupation.

Potential habitat for threatened fauna species, such as den sites or drays for the Squirrel Glider, koala feed trees, forest owl nest sites (i.e. large tree hollows) and potential roosts for microchiropteran bats, was identified.

Fauna survey

The fauna survey comprised two days diurnal bird and reptile surveys, two nights nocturnal call playback for threatened amphibians, arboreal mammals and owls, two nights nocturnal spotlighting for threatened amphibians, arboreal mammals and owls, and deployment of two Anabats to record microchiropteran bats utilising the site. In addition two motion activated cameras were placed in suitable habitats at the site for a period of four weeks.

Bat survey

Craig Grabham (GHD) completed analysis of all bat calls. Bat calls were recorded during field surveys using Anabat detectors (Titley Scientific Brisbane). Data from each detector was downloaded via the CF card using CFCread (version 4.3s Corben 2011). Calls were identified using zero-crossing analysis and AnalookW software (version 3.8v, Chris Corben 2012) by visually comparing the time-frequency graph and call characteristics (e.g. characteristic frequency and call shape) with reference calls and/or species call descriptions from published guidelines.

The *Bat calls of NSW: Region based guide to the echolocation calls of microchiropteran bats* (Pennay *et al*. 2004) was used to assist call analysis. Call identification was also assisted by consulting distribution information for possible species (Pennay *et al*. 2011; Churchill 2008; van Dyck and Strahan 2008) and records from the Atlas of NSW Wildlife (OEH 2013a). No reference calls were collected during the survey.

A call (pass) was defined as a sequence of four or more consecutive pulses of similar frequency. Calls with less than four defined pulses were excluded from the analysis. Due to variability in the quality of calls and the difficulty in distinguishing some species the identification of each call was assigned a confidence rating (see Mills *et al.* 1996 & Duffy *et al.* 2000) as summarised in Table 2-1.

Species nomenclature follows Pennay *et al* (2011), then van Dyck and Strahan (2008).

Table 2-1 Confidence rating applied to Anabat calls

Identification	Description
D - Definite	Species identification not in doubt.
PR - Probable	Call most likely to represent a particular species, but there exists a low probability of confusion with species of similar call type or call lacks sufficient detail.
SG - Species Group	Call made by one of two or more species. Call characteristics overlap making it too difficult to distinguish between species e.g. *Nyctophilus spp.* The calls of *Nyctophilus* species using this method cannot be distinguished during the analysis process and are therefore lumped together.

Ground debris searches

Ground debris searches were undertaken during the survey while incidentally traversing the site. These included active searches for small fauna and opportunistic observation of scats, tracks, burrows or other traces.

Opportunistic observations

Opportunistic and incidental observations of fauna species were recorded at all times during field surveys.

2.2.3 Aquatic habitat survey

Potential habitat for threatened aquatic fauna, such as amphibians, fish and invertebrates, was identified on site. A habitat assessment was undertaken for creeks and dams onsite, documenting nature and condition of riparian and in stream vegetation and aquatic habitats.

2.2.4 Limitations

The current survey was not designed to detect all species present at the site, rather to provide an overall assessment of the ecological values on site. Given the duration and timing of the field survey it is likely that some species that utilise the site (permanently, seasonally or transiently) were not detected during the survey. These species are likely to include flora species that are difficult or impossible to locate or identify at this time of year due to a lack of reproductive material and/or their seasonal nature (in particular, native orchids and forbs).

Site conditions (including the presence of threatened species of flora and/or fauna) may change after the date of this report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

2.2.5 Likelihood of occurrence of threatened species

Following collation of database records and species and community profiles a ‘likelihood of occurrence’ assessment was prepared with reference to the broad habitats contained within the study area. The likelihood of threatened and migratory biota occurring in the study area was assessed based on presence of records from the locality, species distribution and habitat preferences, and quality of potential habitat present in the study area. The results of this assessment are provided in Appendix A.

Table 2-2 provides a key to the likelihood of occurrence in the study area of threatened biota known or likely to occur in the locality.

Table 2-2 Key to likelihood of occurrence for threatened species

Likelihood	Definition
Present	Species recorded during current survey
Likely	Species previously recorded within a 10 kilometre radius of the study area and suitable habitat occurs within the study area.
Possible	Species previously recorded within a 10 kilometre radius of the study area but only marginal suitable habitat recorded, OR Species not previously recorded within a 10 kilometre radius of the study area, but the study area is within the species known distribution and suitable habitat occurs within the study area.
Unlikely	Species previously recorded within a 10 kilometre radius of the study area but no suitable habitat recorded.
Nil	Species not previously recorded within a 10 kilometre radius of the study area, suitable habitat not recorded within subject, and/or study area outside species known distribution.

3. Results

3.1 Database searches

3.1.1 TSC Act

The NSW Wildlife Atlas was searched on 20 August 2013 covering the site plus a 10 kilometre search radius. The search identified 22 threatened fauna and nine threatened flora species listed on the TSC Act that have previously been recorded within 10 km of the site. Threatened flora records and threatened fauna records are shown on Figure 3-1 and Figure 3-2, respectively. Of these, six threatened flora and 15 threatened fauna species have the potential to occur at the site owing to the presence of suitable habitat for these species. An assessment of the likelihood of threatened species to occur within the site is provided in Appendix A.

A review of the LHCCREMS mapping was undertaken to identify endangered ecological communities (EECs) that have been mapped within the site. A total of five EECs were identified within the locality. A list of these EECs is provided in Appendix A.

A copy of the NSW Wildlife Atlas search is provided in Appendix B.

3.1.2 EPBC Act

An EPBC Act Protected Matters search was undertaken on 16 August 2013 covering the site plus a 10 kilometre search radius. The search identifies MNES that have either been recorded or are predicted to occur within the search area.

MNES matters identified within the 10 kilometre search area are:

- 44 threatened species (14 flora and 30 fauna)
- 43 listed migratory species

No threatened ecological communities are predicted to occur within 10 km of the site.

Other matters identified within the 10 kilometre buffer include:

- Seven Commonwealth Lands
- One Commonwealth Heritage Place

A number of marine species also appear on the protected matters search however these species are not relevant to this assessment as the site is approximately 30 km from any marine environments. Marine species are therefore not considered further in this report.

A copy of the EPBC Act Protected Matters search is provided in Appendix C.

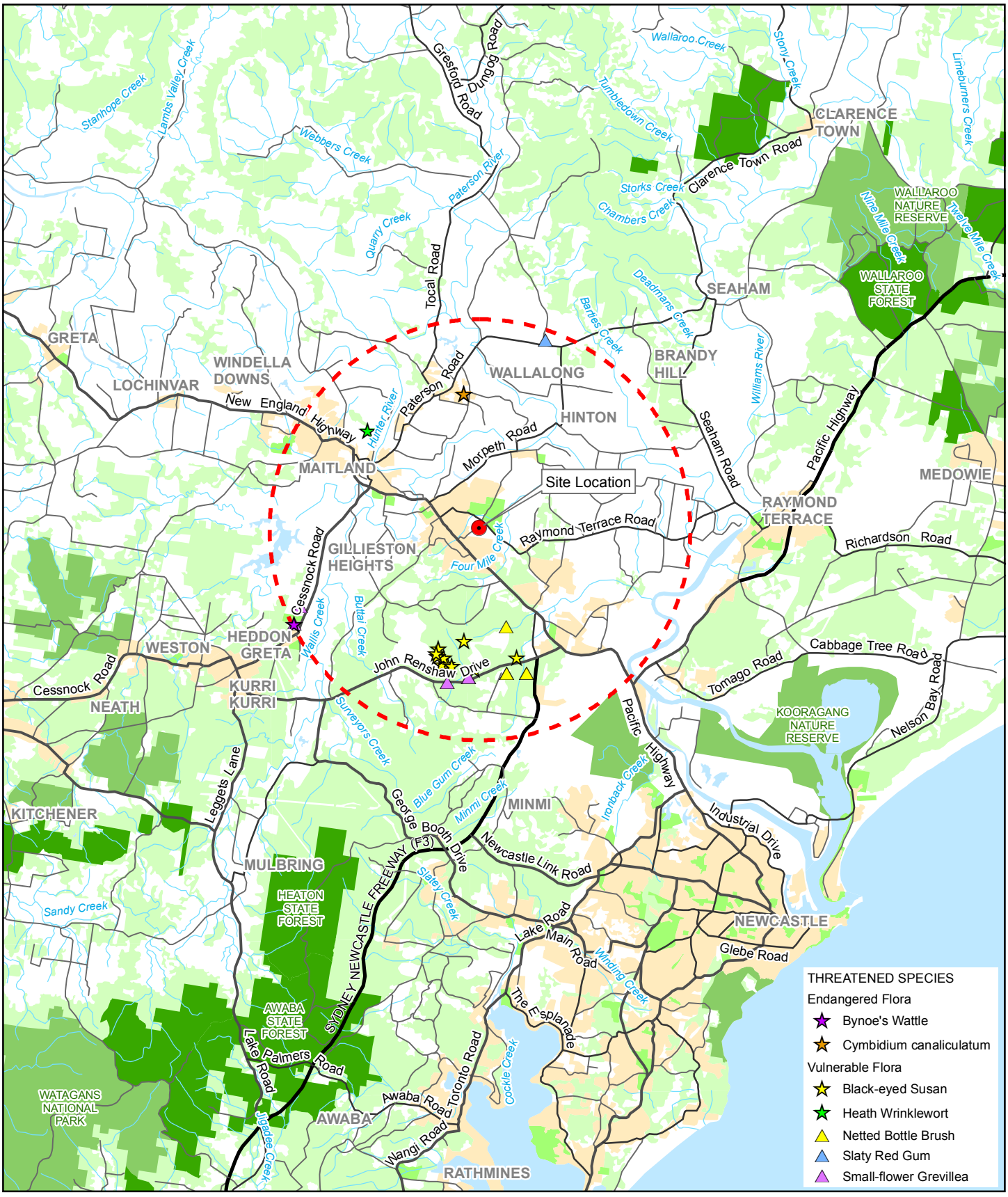
3.1.3 LHCCREMS Vegetation Mapping Review

There are two vegetation types that have been mapped by LHCCREMS (2003) within the study area, these include:

- Lower Hunter Spotted Gum-Ironbark Forest (Map Unit 17).
- Alluvial Tall Moist Forest (Map Unit 5).

Lower Hunter Spotted Gum-Ironbark Forest is widespread throughout the central to lower Hunter Valley with forests between Cessnock and Beresfield forming the core of its distribution. Spotted Gum (*Corymbia maculata)* and Red Ironbark (*Eucalyptus fibrosa)* typically dominate the canopy.

Alluvial Tall Moist Forest occurs in areas of higher rainfall on deep alluvial soils. The community is typically dominated by *Eucalyptus saligna* (Sydney Blue Gum), *Syncarpia glomulifera* (Turpentine), *Eucalyptus robusta* (Swamp Mahogany) and *Angophora floribunda* (Rough Bark Apple).



LEGEND

- Dual Carriageway
- Principal Road
- Secondary Road
- Minor Road
- Watercourse
- Water Body
- Built Up Area
- Recreation Area
- Nature Conservation
- State Forest
- Forest Or Shrub
- Site Location
- 10km Buffer

Paper Size A4

0 1 2 4 6 8

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Metford Quarry and Brickworks Site
Flora and Fauna Assessment

Threatened flora records within 10km (OEH data)

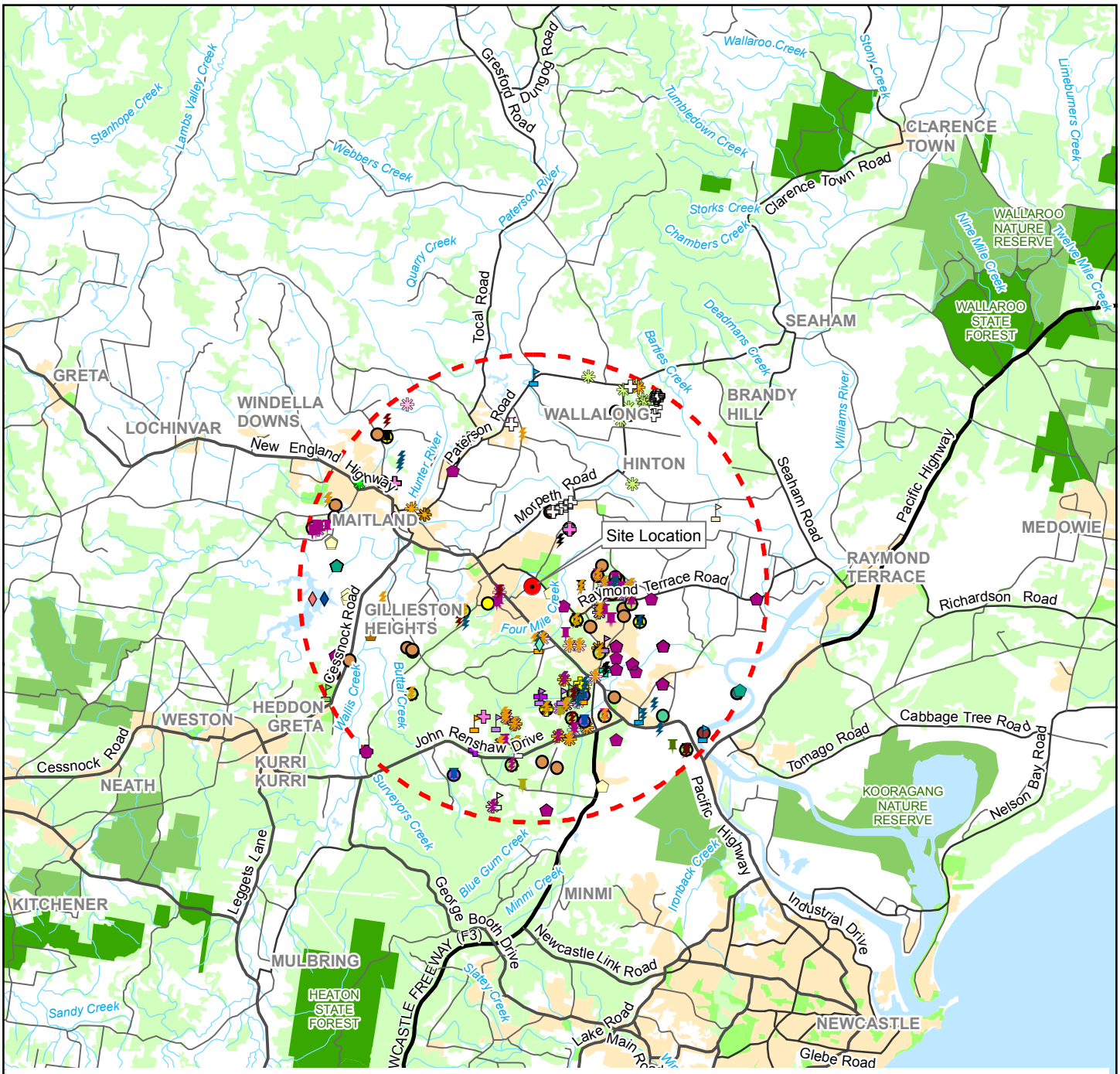
Job Number	22-16974
Revision	0
Date	06 Sep 2013

Figure 3-1

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com.au

G:\22\16974\GIS\Maps\Deliverables\Flora_Fauna_Assessment\22_16974_FFA004_OEHThreatFlora_0.mxd

Data source: Commonwealth of Australia (Geoscience Australia), 250K Topographic Data Series 3, 2006. OEH, NPWS Wildlife, Atlas data, August 2013. Created by: tmorton, gmcdiarmid, fmackay



THREATENED SPECIES

Endangered Fauna
- Australian Painted Snipe
- Black-necked Stork
- Curlew Sandpiper
- Green and Golden Bell Frog
- Little Tern
- Regent Honeyeater
- Swift Parrot

Vulnerable Fauna
- Barking Owl
- Black-breasted Buzzard
- Black-chinned Honeyeater
- Blue-billed Duck
- Brush-tailed Phascogale
- Comb-crested Jacana
- Eastern Bentwing-bat
- Eastern Cave Bat
- Eastern False Pipistrelle
- Eastern Freetail-bat
- Eastern Osprey
- Freckled Duck
- Gang-gang Cockatoo
- Glossy Black-Cockatoo
- Gould's Petrel
- Greater Broad-nosed Bat
- Grey-crowned Babbler
- Grey-headed Flying-fox
- Koala
- Little Bentwing-bat
- Little Eagle
- Little Lorikeet
- Littlejohn's Tree Frog
- Magpie Goose
- Masked Owl
- Powerful Owl
- Rose-crowned Fruit-Dove
- Scarlet Robin
- Sooty Owl
- Southern Myotis
- Spotted-tailed Quoll
- Square-tailed Kite
- Squirrel Glider
- Turquoise Parrot
- Varied Sittella
- White-fronted Chat
- Yellow-bellied Sheathtail-bat

LEGEND
- Dual Carriageway
- Principal Road
- Secondary Road
- Minor Road
- Watercourse
- Water Body
- Built Up Area
- Recreation Area
- Nature Conservation
- State Forest
- Forest Or Shrub
- Site Location
- 10km Buffer

Paper Size A4

0 1 2 4 6 8

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Metford Quarry and Brickworks Site
Flora and Fauna Assessment

Threatened fauna records within 10km (OEH data)

Job Number	22-16974
Revision	0
Date	06 Sep 2013

Figure 3-2

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com.au

G:\22\16974\GIS\Maps\Deliverables\Flora_Fauna_Assessment\22_16974_FFA005_OEHThreatFauna_0.mxd

Data source: Commonwealth of Australia (Geoscience Australia), 250K Topographic Data Series 3, 2006. OEH, NPWS Wildlife, Atlas data, August 2013. Created by: tmorton, gmcdiarmid, fmackay

3.2 Flora

3.2.1 Flora species

A combined total of 140 flora species, including 100 native species, was recorded within the site during the field survey. A full list of flora recorded is provided in Appendix D.

No threatened flora species were recorded within the site.

3.2.2 Vegetation communities

Native vegetation within the site occurs as small isolated remnant or regrowth patches, surrounded by existing disturbance, including cleared residential land, sporting ovals roads and other infrastructure.

Based on the fine-scale vegetation mapping and flora sampling, six vegetation types were recorded within the study area, of which five are native, and one is exotic. These are:

- Lower Hunter Spotted Gum Ironbark Forest
- Hunter Lowland Red Gum Forest
- Freshwater Wetland
- Artificial Wetlands
- Acacia regrowth
- Disturbed/cleared land

Vegetation communities mapped within the site are shown on Figure 3-3 and described in detail below. Vegetation communities have been described according to LHCCREMS (2003) map units where applicable.

Vegetation communities mapped at the site, their extent and conservation status are summarised in Table 3-1. There are several differences between the LHCCREMS vegetation types map for the site and those mapped during the field investigations. The most notable of these differences in the absence of Alluvial Tall Moist Forest from the study area as mapped by LHCCREMS and the presence of two vegetation types not recorded by LHCCREMS (Hunter Lowland Red Gum Forest and Freshwater Wetland).

Table 3-1 Vegetation communities within the site

Vegetation type	Map Unit (LHCCREMS, 2005)	TSC Act Status	EPBC Act Status	Area (Ha)
Hunter Lowland Red-gum Forest	Hunter Lowland Red-gum Forest	Hunter lowland red-gum forest in the Sydney Basin and NSW North Coast bioregions EEC	Not listed	2.5
Hunter Lowland Red-gum Forest (disturbed)	Hunter Lowland Red-gum Forest	Hunter lowland red-gum forest in the Sydney Basin and NSW North Coast bioregions EEC	Not listed	1.4
Lower Hunter Spotted Gum Ironbark Forest	Lower Hunter Spotted Gum Ironbark Forest	Lower Hunter Spotted Gum- Ironbark Forest in the Sydney Basin bioregion EEC	Not listed	14.6
Lower Hunter Spotted Gum Ironbark Forest (disturbed)	Lower Hunter Spotted Gum Ironbark Forest	Lower Hunter Spotted Gum- Ironbark Forest in the Sydney Basin bioregion EEC	Not listed	1.5
Freshwater Wetland	Freshwater Wetland Complex	Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions EEC	Not listed	0.5
Artificial wetlands / waterbodies	Freshwater Wetland Complex	Not listed	Not listed	3.6
Acacia regrowth	Not listed	Not listed	Not listed	7.6
Disturbed / Cleared Land	Not listed	Not listed	Not listed	28.6
TOTAL				**60.3**

* EEC = endangered ecological community

Spotted Gum Ironbark Forest

Spotted Gum Ironbark Forest (LHCCREMS MU 17) (Plate 1) is the dominant vegetation type on the site. This community is present in the southwestern and southeastern corners of the site. This community is associated with sandy clay soils of moderate fertility on mid-slopes. This vegetation type is an open forest dominated by Spotted Gum (*Corymbia maculata*) and *Eucalyptus fibrosa* (Red Ironbark) with occasional *Eucalyptus punctata* (Grey Gum), *Eucalyptus agglomerata* (Blue leaved Stringybark) and *Eucalyptus crebra* (Narrow leaved Ironbark). The midstorey is generally open with sparse shrubs of *Bursaria spinosa* (Blackthorn), *Acacia elongata* (Swamp Wattle), *Acacia parvipinnula* (Silver-stemmed Wattle), *Acacia falcata*, *Ozothamnus diosmifolius* (White Dogwood), *Daviesia ulicifolia* (Gorse Bitter Pea), *Lissanthe strigosa* (Peach Heath), *Pultenaea retusa* and *Dillwynia retrors*a. Throughout the study area there is also dense patches of the noxious exotic shrub *Lantana camara* (lantana) within this vegetation type. The groundlayer of the community generally has a relatively low diversity of native grasses and herbs, Common species include *Themeda triandra* (Kangaroo Grass), *Entolasia stricta* (Forest wiregrass), *Lomandra multiflora* subsp. *multiflora* (Many-flowered Mat rush), *Aristida vagans* (Threeawn Speargrass), *Microlaena stipoides* (Weeping Grass), *Pratia purpurascens* (Whiteroot), *Dichondra repens* (Kidney Weed) and *Caladenia carnea* (Pink Fingers).

Exotic species present within this community include *Lantana camara* (Lantana), *Freesia* sp. (Freesia), *Bidens pilosa (*Cobblers Pegs), *Hyparrhenia hirta* (Coolatai Grass), *Conyza bonariensis* (Purpletop), *Sida rhombifolia* (Paddy's Lucerne), *Ligustrum lucidum* (Large Leaved-privet) and *Senecio madagascariensis* (Fireweed).

This community is commensurate with the TSC Act listed EEC Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin bioregion.

Spotted Gum- Ironbark Forest covers approximately 16.1 hectares of the study area, of which 1.5 hectares is significantly degraded.

Plate 1 Spotted Gum Ironbark Forest in south-western corner of site

Hunter Lowland Red-gum Forest

Within the study area Hunter Lowland Red-gum Forest (LHCCREMS MU 19) (Plate 2) occurs on low lying areas such as drainage flats and depressions. The open woodland is dominated by *Eucalyptus tereticornis* (Forest Red Gum) with *Angophora floribunda* (Rough barked Apple), *Eucalyptus agglomerata* (Blue-leaved Stringybark) and *Eucalyptus fibrosa* (Red Ironbark) also common. Common shrubs within the mid-strata include *Bursaria spinosa* (Blackthorn), *Daviesia ulicifolia* (Gorse Bitter Pea), *Breynia oblongifolia* (Coffee Bush), *Acacia elongata* (Swamp Wattle), *Acacia parvipinnula* (Silver-stemmed Wattle) and *Acacia falcata*. Along Two Mile creek there are also dense thickets of *Sannantha pluriflora*. The ground storey of this community consists of a diverse mix of grasses and herbs, including *Microlaena stipoides* (Weeping Grass), *Themeda triandra* (Kangaroo Grass), *Echinopogon ovatus* (Hedgehog Grass), *Viola hederacea* (Ivy-leaved Violet), *Clematis aristidea* (Old Man's Beard), *Goodenia hederacea* (Ivy Goodenia), *Cheilanthes sieberi subsp sieberi* (Rock Fern) and *Pratia purpurascens* (Whiteroot). Common vines include *Clematis aristata* (Old Man's Beard) and *Parsonsia straminea* (Common Silkpod).

There are dense infestations of the noxious weed *Lantana camara* (Lantana) present throughout this vegetation type. Other common exotic species present within this community include *Bidens pilosa (*Cobblers Pegs), *Conyza bonariensis* (Purpletop), *Ligustrum lucidum* (Large Leaved-privet) and *Senecio madagascariensis* (Fireweed).

Hunter Lowland Red-gum Forest is present in two discrete patches within the study area, one occurs along the north-eastern boundary of the brickworks site and the second occurs along Two Mile Creek in the western portion of the study area. The patch surrounding Two Mile Creek is highly degraded with the majority of the mid story removed and the understory dominated by exotic species.

This community is commensurate with the TSC Act listed EEC Hunter lowland red-gum forest in the Sydney Basin and NSW North Coast bioregions.

Hunter Lowland Redgum Forest covers approximately 3.9 hectares of the study area, of which 1.4 hectares is significantly disturbed (see Table 3-1).

Plate 2 Hunter Lowland Redgum Forest in north of site

Freshwater Wetlands

There is a small patch of Freshwater Wetland (LHCCREMS MU 46) (Plate 3) which occurs in a low lying depression adjacent to Two Mile Creek. This community is dominated by rushes, sedges and other aquatic plants. Common species include *Typha orientalis* (Broad-leaved Cumbungi), *Phragmites australis* (Common Reed), *Juncus usitatus* (Common rush), *Persicaria decipiens* (Slender Knotweed) and *Ludwigia peploides* subsp*. montevidensis* (Water Primrose) and *Eleocharis sphacelata* (Tall Spike Rush) and *Cyperus exaltatus.*

This community is commensurate with the TSC Act listed EEC, Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions.

Freshwater Wetlands cover approximately 0.5 hectares of the study area (Table 3-1).

Plate 3 Freshwater wetland to west of Two Mile Creek

Artificial wetlands and waterbodies

Throughout the study area there is a number of water bodies and artificial wetland areas that have developed around quarry pits (Plate 4). These areas are dominated primarily by *Typha orientalis* (Broad-leaved Cumbungi) with *Juncus usitatus* (Common rush), *Persicaria decipiens* (Slender Knotweed), *Cyperus* spp. (sedges) and *Philydrum lanuginosum* (Frogs mouth).

Artificial wetlands and water bodies cover approximately 3.7 hectares of the study area

Plate 4 Artificial wetland in old quarry pit

Acacia regrowth

There are numerous areas within the site that have been disturbed by mining activities where native vegetation has begun to regenerate (Plate 5). These areas are dominated by Acacia regrowth, with common species including *Acacia elongata* (Swamp Wattle), *Acacia parvipinnula* (Silver-stemmed Wattle) and, *Acacia falcata*. Other species common in these areas include *Ozothamnus diosmifolius* (White Dogwood), *Daviesia ulicifolia* (Gorse Bitter Pea), *Hibbertia fasciculata, Imperata cylindrica (*Blady Grass), *Themeda triandra* (Kangaroo Grass), *Chrysocephalum apiculatum* (Common Everlasting) and *Lomandra multiflora* subsp. *multiflora* (Many-flowered Mat rush). These areas also contain a high abundance of the noxious weeds *Lantana camara* (Lantana) and *Cortaderia selloana* (Papas Grass).

Areas of acacia regrowth cover approximately 7.6 hectares of the study area (Table 3-1).

Plate 5 Acacia regrowth in disturbed area in west of old brickworks site

Disturbed/cleared land

The remainder of the site has been subject to major disturbance through past development. This category includes exotic vegetation, former quarry areas, tracks, hardstand, and other infrastructure and is mapped collectively as disturbed / cleared land (Plate 6).

Areas of disturbed / cleared land cover approximately 28.6 hectares of the study area, which represents nearly half the total study area (Table 3-1).

Plate 6 Disturbed / cleared land surrounding quarry

Paper Size A4

0 25 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Site Boundary
- Cadastre
- Watercourse
- Quadrat
- EEC

Metford Quarry and Brickworks Site
Flora and Fauna Assessment

Job Number	22-16974
Revision	0
Date	06 Sep 2013

Vegetation and EEC's

Figure 3-3

G:\22\16974\GIS\Maps\Deliverables\Flora_Fauna_Assessment\22_16974_FFA002_Vegetation_0.mxd

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com.au

Data source: LPI: DCDB & DTDB - 2012; Google Earth: Aerial Imagery 2013. Created by: fmackay, tmorton

3.2.3 Noxious and environmental weeds

The *Noxious Weeds Act 1993* provides for the declaration of noxious weeds in local government areas. Landowners and occupiers must control noxious weeds according to the control category specified in the Act. Public authorities must control noxious weeds according to the control category to the extent necessary to prevent their spread to adjoining land.

The site contains 40 exotic flora species, of which six are declared as noxious weeds in the Maitland local government area (LGA). A list of noxious weeds recorded within the study area is provided in Table 3-2.

Lantana camara (Lantana) is present in dense thickets throughout the study area, in particular in the western section of the site. Within these thickets there is a low density of native herbs and a very limited or absent native midstory. *Ageratina adenophora* (Crofton Weed) occurs as a dense infestation along a drainage line that runs through the centre of the site. *Rubus fruticosus* spp. agg. (Blackberry) and *Chrysanthemoides monilifera* subsp. *monilifera* (Boneseed) occur as a few isolated individuals within the Spotted Gum Ironbark Forest, while *Bryophyllum delagoense* (Mother of Millions), is scattered throughout the site. *Cortaderia selloana (*Pampas Grass) is predominantly confined to disturbed areas and within patches of acacia regrowth.

In addition to these noxious weeds there are a number of environmental weeds present within and surrounding areas of native vegetation. These include *Chloris gayana* (Rhodes Grass), *Senecio madagascariensis* (Fireweed), *Panicum maximum* var. *maximum*, *Lonicera japonica* (Japanese Honeysuckle), *Olea europaea* subsp. *cuspidata* (African Olive), *Hyparrhenia hirta* (Coolatai Grass) *Ligustrum lucidum* (Large Leaved Privet) and *Ligustrum sinense* (Small Leaved Privet).

Table 3-2 Declared noxious weeds of the Maitland LGA recorded during the field survey

Scientific name	Common name	Control Class
Lantana camara	Lantana	5
Cortaderia selloana	Pampas Grass	4
Chrysanthemoides monilifera	Boneseed	4
Rubus fruticosus spp. agg.	Blackberry	4
Bryophyllum delagoense	Mother of Millions	3
Ageratina adenophora	Crofton Weed	4

For control class 4: ‘the growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority’. For control class 5: ‘the requirements in the NW Act for a notifiable weed must be complied with’.

Control class 4 weeds must be fully and continuously suppressed and destroyed and the plant must not be sold propagated or knowingly distributed.

3.2.4 Conservation significance

Threatened flora species

The desktop literature review reveals that 19 threatened plant species listed under the TSC and/or EPBC Act have been previously recorded, or are predicted to occur in the locality. The full list of plant species of conservation significance predicted to occur or previously recorded in the locality, including their habitat requirements and conservation status is presented in Appendix A.

A 'likelihood of occurrence' assessment was prepared with reference to the broad habitats contained within the study area. This was further refined following field surveys. The likelihood of threatened flora occurring in the study area was assessed based on presence of records from the locality, species distribution and habitat preferences, and quality of potential habitat present in the study area. The results of this assessment are provided in Appendix A.

The majority of the threatened flora species known or predicted to occur in the locality are considered unlikely to occur on the site as they have limited ranges and/or habitat requirements, which are not present. There is suitable habitat for six threatened plant species at the site. These include

- *Cryptostylis hunteriana* (Leafless Tongue Orchid)
- *Eucalyptus glaucina* (Slaty Red Gum)
- *Persicaria elatior* (Knotweed)
- *Pterostylis gibbosa* (Illawarra Greenhood)
- *Maundia triglochinoides*
- *Tetratheca juncea* (Black-eyed Susan)

None of these species were recorded during targeted searches during the field survey. However, a number of cryptic species, including two species of orchid (*Cryptostylis hunteriana* and *Pterostylis gibbosa*), were not surveyed during their flowering periods. Owing to the presence of suitable habitat at the site, these species are considered to have the potential to occur within the site. Surveys during their flowering periods, with positive identification of flowering from a local reference site during the survey period, would be required to provide a more confident assessment of the presence or absence of orchid species at the site.

Endangered ecological communities

The desktop literature review indicates seven EECs listed under the TSC Act are known to occur in the locality. Three of these EEC were recorded within the study area as shown in Figure 3-3. These include:

- Lower Hunter Spotted Gum Ironbark Forest
- Hunter Lowland Red-gum Forest
- Freshwater Wetlands on Coastal Floodplains

No EECs listed under the EPBC Act have been recorded or are predicted to occur in the locality (LHCCREMS 2003, DSEWPaC 2013).

Descriptions of these EECs are provided below and the full list of EECs known from the region, including their habitat requirements and conservation status, is presented in Appendix A.

Hunter Lowland Redgum Forest EEC

Hunter Lowland Red-gum Forest mapped within the study area is characteristic of Hunter Lowland Redgum Forest EEC (NSWSC 2002), listed under the TSC Act. This EEC occurs from Muswellbrook to the Lower Hunter in the Sydney Basin and North Coast bioregions. It has been recorded from the Maitland, Cessnock, Port Stephens, Muswellbrook and Singleton LGAs, but may occur elsewhere in these bioregions. Less than 27% of the community remains with much of it disturbed and fragmented (NSWSC 2002).

This community is dominated by *Eucalyptus tereticornis (*Forest Red Gum)*, Angophora floribunda* (Rough Barked Apple*)* and *E. punctata* (Grey Gum). Other frequently occurring canopy species include *E. fibrosa* (Red Ironbark), *E. crebra* (Narrow-leaved Ironbark*)* and *E*. *agglomerata* (Broad Leaved Stringybark). The mid-storey is open and characterised by sparse shrubs such as Coffee Bush (*Breynia oblongifolia)*, Prickly Beard-heath (*Leucopogon juniperinus)*, Gorse Bitter Pea (*Daviesia ulicifolia)* and Dogwood (*Jacksonia scoparia)*. The ground cover typically comprises grasses and herbs (NSWSC 2002).

Parts of the study area mapped as Hunter Lowland Red-gum Forest are characteristic of Hunter Lowland Redgum EEC. Of the 36 species from this assemblage that are listed in the Final Determination as characterising the EEC, 17 species (53%) were recorded within the site. This community is associated with creeks and drainage lines within the site contain a high abundance of weed species including dense thickets of the noxious weed *Lantana camara* (Lantana).

Lower Hunter Spotted Gum Ironbark Forest EEC

Lower Hunter Spotted Gum Ironbark Forest within the site is characteristic of Lower Hunter Spotted Gum-Ironbark Forest EEC (NSWSC 2005a), listed under the TSC Act. This EEC is restricted to a range of approximately 65 kilometres by 35 kilometres centred on the Cessnock - Beresfield area in the Central and Lower Hunter Valley. Within this range, the community was once widespread. A fragmented core of the community still occurs between Cessnock and Beresfield (NSWSC 2005a).

This community is dominated by *Corymbia maculata (*Spotted Gum) and *Eucalyptus fibrosa* (*Red Ironbark*), with occasional *E. punctata* (Grey Gum) and *E. crebra* (Narrow leaved Ironbark). The understorey is marked by the tall shrub, *Acacia parvipinnula*, and by the prickly shrubs, *Daviesia ulicifolia, Bursaria spinosa,* and *Lissanthe strigosa*. The ground layer is diverse; commonly recorded species include *Cheilanthes sieberi, Dianella revoluta, Entolasia stricta, Glycine clandestina, Lepidosperma laterale, Lomandra multiflora, Microlaena stipoides, Pomax umbellata, Pratia purpurascens, Themeda australis* and *Phyllanthus hirtellus* (NSWSC 2005a).

Parts of the study area mapped as Lower Hunter Spotted Gum Ironbark Forest are characteristic of Lower Hunter Spotted Gum Ironbark EEC. Of the 55 species from this assemblage that are listed in the Final Determination as characterising the EEC, 25 species (45%) are present in the investigation area.

Within the western portion of the site, this community contains low species diversity a high abundance of weed species, including dense thickets of the noxious weed *Lantana camara* (Lantana), while the patch within the southeastern section of the study area is in relatively good condition with high species diversity and a low abundance of weeds.

Freshwater Wetland on Coastal Floodplains EEC

Freshwater Wetlands are associated with coastal areas subject to periodic flooding and in which standing fresh water persists for at least part of the year in most years. This community typically occurs on silts, muds or humic loams in low-lying parts of floodplains, alluvial flats, depressions, drainage lines, backswamps, lagoons and lakes but may also occur in backbarrier landforms where floodplains adjoin coastal sandplains. Freshwater wetlands are dominated by herbaceous plants and have very few woody species. This community has been extensively cleared and modified, with approximately 3,500 hectares reported as remaining in the lower Hunter – Central Hunter region in the 1990s (NSWSC 2004).

Parts of the study area mapped as Freshwater Wetland are characteristic of Freshwater Wetland EEC listed under the TSC Act. Of the 66 species from this assemblage that are listed in the Final Determination (NSWSC 2004) as characterising the EEC, 9 species (14%) are present in the investigation area. Within the study area this community occurs as a small degraded patch containing low species diversity adjacent to Two Mile Creek.

3.3 Fauna

3.3.1 Fauna species

Forty-five native fauna species and two exotic fauna species was recorded at the site during the field survey (see Appendix D). This section summarises the results of the fauna survey in terms of broad fauna assemblages.

Fauna surveys recorded a moderate (30) number of native birds within the site. Guilds and species observed included:

- Forest birds including Grey Fantail (*Rhipidura albiscapa*), Grey Strike-thrush (*Colluricincla harmonica*), Australian Magpie (*Cracticus tibicen*), Willie-wagtail (*Rhipidura leucophrys*), and Superb Fairy-wren (*Malurus cyaneus*).
- Raptors including Black-shouldered Kite (*Elanus axillaris*).
- Parrots common in suburban and agricultural landscapes such as the Galah (*Eolophus roseicapillus*) and Eastern Rosella (*Platycercus adscitus eximius*).
- Wetland species including White-faced Heron (*Egretta novaehollandiae*), Little Egret (*Egretta garzetta*), Royal Spoonbill (*Platalea regia*), Purple Swamphen (*Porphyrio porphyria),* Australian Wood Duck (*Chenonetta jubata)*, Australian Grebe (*Tachybaptus novaehollandiae*), Eurasian Coot (*Fulica atra*) and Pacific Black Duck (*Anas superciliosa).*

No reptiles were recorded; likely a reflection of the winter survey period when minimal reptile activity is normally recorded.

Two common frog species were heard calling within the small dams within the eastern portion of the site, the Eastern Common Froglet (*Crinia signifera*) and Spotted Marsh Frog (*Limnodynastes tasmaniensis*) Good quality habitat for amphibians occurs within interconnecting dams and creek lines at the site, which is likely to provide habitat for a wider variety of species. The low number of frogs recorded is likely a reflection of the winter survey period when minimal amphibian activity is normally recorded

No arboreal mammals (such as possums and gliders) were recorded, although potential foraging and denning habitat is available. The only ground-dwelling mammal recorded was the introduced Rabbit (*Oryctolagus cuniculus*), although tracks and scats from macropods were recorded.

Grey-headed Flying-fox (*Pteropus poliocephalus*), listed as vulnerable on the TSC Act and EPBC Act, was recorded flying over the site, and potential foraging habitat for the species occurs onsite. There are no Grey-headed Flying-fox camp sites at the site.

Several microchiropteran bat species and species groups were recorded via Anabat (Table 3-3), including definite call sequences from Little Bent-wing Bat (*Miniopterus australis)* listed as vulnerable on the TSC Act. Calls identified to species groups included several other microchiropteran bat species listed as vulnerable on the TSC Act, including Greater Broad-nosed Bat (*Scoteanax rueppellii),* Eastern False Pipistrelle *(Falsistrellus tasmaniensis),* Eastern Bent-wing Bat *(Miniopterus schreibersii oceanensis)* and Eastern Cave Bat *(Vespadelus troughtoni).*

Table 3-3 Microchiropteran bats recorded via Anabat

Species and confidence rating	Total number of recordings
Greater Broad-nosed Bat (*Scoteanax rueppellii)* / Eastern Broad-nosed Bat *Scotorepens orion/* Eastern False Pipistrelle *(Falsistrellus tasmaniensis)* (SG)	1
Nyctophilus sp. (D)	6
Vespadelus sp. / Eastern Bent-wing Bat *(Miniopterus schreibersii oceanensis)* (SG)	2
Little Forest Bat *(Vespadelus vulturnus)* / Eastern Cave Bat *(V. troughtoni)* / Eastern Forest Bat *(V. pumilus)* (SG)	53
Vespadelus sp./ Chocolate Wattled Bat (*Chalinolobus morio)* (SG)	1
Eastern Forest Bat *(Vespadelus pumilus)* (D)	8
Little Bent-wing Bat *(Miniopterus australis)* (D)	93
Other bat calls (unidentifiable)	4

D: Definite; SG: Species Group; P: Probable (see Table 2-1).

3.3.2 Habitats

Habitat assessments were conducted across the entire site in order to determine the conservation significance of fauna habitats and to assess the potential presence of native fauna (and especially threatened species) not directly observed during the surveys.

Habitat features and resources are described in terms of the native fauna they may support with specific reference to threatened species potentially present in the site. Important habitat resources are mapped on Figure 3-4.

The habitat assessment identified the following main habitat types across the study area:

- Forest
- Wetlands
- Modified environments

These habitat types are described below, with accompanying photographs included (see Plates 7 to 10).

Forest

Spotted Gum Ironbark Forest and Redgum Open Forest at the site are likely to have equivalent habitat value for native fauna and so are assessed together. Forest at the site is in moderate to good condition. It contains healthy, young to mature trees forming a canopy with a forest or open forest structure (Specht, 1970). The site features moderate recruitment of juveniles and seedlings. Based on these structural attributes, forest at the site would be expected to support a diverse range of native birds, microbats and arboreal mammals.

There are large numbers of mature Red Ironbark, Spotted Gum and Forest Red Gum at the site, which would provide foraging resources for native fauna, including native parrots and arboreal mammals. Forest at the site provides potential shelter and foraging resources for arboreal mammals, such as the threatened Squirrel Glider (*Petaurus norfolcensis)*, Sugar Glider (*Petaurus breviceps*) and common possums.

Small trees and shrubs are important for many bird species and arboreal mammals, such as the Sugar Glider and Squirrel Glider. The site contains a well-defined and diverse shrub layer, including a range of wattles (*Acacia* sp.), which provide shelter and foraging resources such as nectar, sap and fruits.

No she-oaks (*Allocasuarina* sp.), some of which represent feed trees for the threatened Glossy Black Cockatoo (*Calyptorhynchus lathami*), occur onsite.

There are few hollow-bearing trees and stags within the forest habitats at the site. Most hollow-bearing trees support small (5-10 cm) hollows suitable for microbats and small arboreal mammals (such as Sugar Gliders). No trees with large hollows suitable for owl nests were recorded on the site. Habitat trees are plotted in Figure 3-4 and discussed in further detail below.

Plate 7 Forest habitat

Wetlands

Small wetlands on site are characterised by dense native sedges and reeds including Broad-leaf Cumbungi, Common Reed (*Phragmites australis*), Sharp Rush (*Juncus acutus),* Common Rush, *Eleocharis acuta,* Water Primrose, Tall Spike Rush and *Cyperus exaltatus*. Wetland areas provide good quality habitat for amphibians, with permanent aquatic habitat including instream and fringing native vegetation, macrophytes, in stream woody debris, open water and connections to terrestrial habitats, including rocky basking sites. There are several historical records for the threatened Green and Golden Bell Frog (*Litoria aurea*) within 10 km of the site; however no recent records within 5 km of the site. Given the lack of recent records for the species it is unlikely the site represents potential habitat for Green and Golden Bell Frog.

The introduced Mosquito Fish (*Gambusia holbrooki*), a known predator of native tadpoles, was recorded within the wetland areas. The presence of this introduced predator significantly decreases the site's value for amphibians.

The small wetlands onsite offer good quality habitat for common macroinvertebrates, with a variety of microhabitats including fringing and instream native vegetation, instream woody debris and deep pools. Several ephemeral creeklines connect the small dams and would offer a further variety of microhabitats (such as riffle zones) in times of high flow. The small dams and ephemeral creeklines onsite are unlikely to provide habitat for native fish due to the isolation from natural creeklines.

The large dam located in the western section of the site contains deep pools and some fringing native vegetation. The dam has been stocked with recreational species, which are thriving according to local residents. Two Mile Creek extends through the northwest corner west of the large dam. This creek is characterised by a formed channel approximately two metres wide with dense Lantana and Broad-leaf Cumbungi within and adjacent to the creek. Low-lying wetlands dominated by Broad-leaf Cumbungi occur adjacent to the creek. This creek flows northeast and joins with Four Mile Creek approximately two kilometres northeast of the site. Two Mile Creek provides habitat for common native fish, but is not suitable habitat for Platypus (*Ornithorhynchus anatinus*). No threatened fish or invertebrates listed on the FM Act would occur in Two Mile Creek, as the study area is outside the distribution range of threatened fish listed on the FM Act, and the habitat characteristics for threatened invertebrates are not present in the study area.

Plate 8 One of the small wetlands located in the northeast of the site

Plate 9 The large dam in the western portion of the site

Modified environments

Patches of planted native vegetation and exotic plants provide foraging resources for a selection of mobile fauna, particularly birds. However these areas are virtually free of natural shelter such as rock fragments, tree hollows or woody debris and contain only patchy vegetation cover. Where these vegetation types occur adjacent to native vegetation they may have a value as a buffer or as supplementary habitat for the native forest and wetland fauna described above. Smaller patches of vegetation are only likely to support opportunistic species tolerant of fragmented landscapes. These may include native bird species such as the Australian Magpie and Australian Magpie-lark (*Grallina cyanoleuca*) and exotic fauna such as the European Rabbit and Red Fox (*Vulpes vulpes*).

Previous cleared areas from quarrying and access roads contain extremely limited resources for both native and exotic animals.

Other habitat resources

DEC (2004) identify “special habitats” (e.g. large, mature or hollow bearing trees, rocky outcrops and cliffs) that are likely to support specific fauna assemblages. These resources may be significant for threatened species OEH (2013b). Notably, tree hollows are important for native fauna as diurnal or nocturnal shelter sites, for rearing young, for feeding, for thermoregulation, and to facilitate ranging behaviour and dispersal. Accordingly, the field survey included a targeted survey of specific habitat resources in addition to the assessment of the habitat types described above.

The site contains habitat trees, including approximately 14 hollow-bearing trees and stags (refer Plate 10). The site contains sufficient quantities of these resources to support local populations of hollow-dependant fauna.

Hollow-bearing trees may provide suitable diurnal roost sites for tree-roosting microbats, including the threatened Eastern Freetail Bat (*Mormopterus norfolkensis)* and Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris)* and may provide diurnal shelter for cave-roosting species such as the Eastern Bentwing-bat and Little Bentwing-bat. They are also likely to provide roost and nest sites for native parrots, including the Red-rumped Parrot (*Psephotus haematonotus*) and Galah, and potentially also threatened species such as the Little Lorikeet (*Glossopsitta pusilla)*.

The site contains moderate amounts of standing and fallen dead timber, which would provide shelter and foraging resources for native invertebrates, reptiles and small terrestrial mammals. In addition, several small areas of rocky outcrops occur, providing important habitat for reptiles.

Plate 10 Habitat tree

3.3.3 Conservation significance

TSC Act

Two threatened species listed as vulnerable on the TSC Act, the Grey-headed Flying-fox and Little Bent-wing Bat, were recorded onsite. Anabat calls identified to species groups included several other microchiropteran bat species listed as vulnerable on the TSC Act, including Greater Broad-nosed Bat, Eastern False Pipistrelle, Eastern Bent-wing Bat and Eastern Cave Bat. The site provides foraging habitat for Grey-headed Flying-fox, and foraging and roosting habitat for microchiropteran bats.

The desktop review indicates the potential presence of a further 29 threatened fauna species are likely to occurrence at the site based on the presence of suitable habitat and recent local records of the species. This includes Black-necked Stork, Southern Myotis, Eastern Bentwing-bat, Eastern Cave Bat, Eastern Freetail-bat, Greater Broad-nosed Bat and Yellow-bellied Sheathtail-bat. In addition to these species there is a possibility that a further 22 threatened fauna species listed under the TSC Act could occur at the site owing to the presence of suitable habitat.

The full list of threatened fauna, including their conservation status, habitat requirements, previous records and likelihood of occurrence is presented Appendix A.

FM Act

A review of the NSW Primary Industries Threatened and protected species records viewer indicates that no threatened species listed on the FM Act have been previously recorded in the Hunter-Central Rivers CMA. A review of the species profiles for threatened species listed on the FM Act indicates the site is outside the distribution range of threatened fish, and the habitat characteristics for threatened invertebrates are not present in the study area.

EPBC Act matters

Threatened species

One threatened species listed as vulnerable on the EPBC Act, Grey-headed Flying-fox, was recorded onsite. Based on desktop and habitat assessments, four EPBC Act listed fauna species have the potential to occur at the site on an occasional or opportunistic basis, including Painted Snipe, Red Goshawk, Australasian Bitten and Regent Honeyeater.

The full list of threatened fauna, including their conservation status, habitat requirements, previous records and likelihood of occurrence is presented in Appendix A.

Migratory species

Native vegetation at the site is likely to be used by a range of migratory species on a periodic basis. This would potentially include use of foraging resources by threatened migratory species, including the Swift Parrot (*Lathamus discolor*) and Regent Honeyeater (*Xanthomyza phrygia*).

The full list of migratory fauna, including their conservation status, habitat requirements, previous records and likelihood of occurrence is presented in Appendix A.

3.3.4 SEPP 44 Koala habitat assessment

Area of the site mapped as Hunter Lowland Redgum Forest constitute 'Potential Koala habitat' as defined under *State Environmental Planning Policy No. 44* (SEPP 44) which is defined as 'an area of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component'. The site contains two Koala (*Phascolarctos cinereus*) feed tree species listed on Schedule 2 of SEPP 44, Forest Red Gum (*Eucalyptus tereticornis)* and Grey Gum (*E. punctata*). Forest Red Gum and Grey Gum comprise at least 75% of the total number of tree in areas of Red Gum Open Forest. No other vegetation communities (including Spotted-Gum Ironbark Forest) mapped onsite represent potential koala habitat, as less than 15% of the total number of trees in the upper or lower strata of the tree component are koala feed tree species.

Core Koala habitat, is defined under SEPP 44 as 'an area of land with a resident breeding population of Koalas, evidenced by attributes such as breeding females and recent sightings and historical records of a population'. Targeted surveys for Koalas and searches for signs of recent Koala activity (such as scats) were conducted during the current survey. No evidence of the species was detected. There are no recent OEH (2013a) records of Koalas at or in the immediate vicinity of the site, nor any other evidence that the site supports a local population of the Koala, including records of breeding females or scats. Therefore the site does not constitute "core Koala habitat".

Paper Size A4

0 25 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Site Boundary
- Cadastre
- Watercourse
- Fauna Habitat assessment
- Camera trap
- Anabat
- Call playback
- Habitat tree
- Spotlight transect

Metford Quarry and Brickworks Site
Flora and Fauna Assessment

Job Number	22-16974
Revision	0
Date	06 Sep 2013

Fauna Habitat
Types and Resources

Figure 3-4

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Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com.au

Data source: LPI: DCDB & DTDB - 2012; Google Earth: Aerial Imagery 2013. Created by: fmackay, tmorton

4. Biodiversity Values of the Site

4.1 Flora and vegetation communities

The site contains a moderate diversity of native flora species and although no threatened flora species were recorded within the study area during the site assessment, there is suitable habitat for six flora species listed under the TSC and/or EPBC Act. These species are:

- *Cryptostylis hunteriana* (Leafless Tongue Orchid)
- *Eucalyptus glaucina* (Slaty Red Gum)
- *Persicaria elatior* (Knotweed)
- *Pterostylis gibbosa* (Illawarra Greenhood)
- *Maundia triglochinoides*
- *Tetratheca juncea* (Black-eyed Susan)

There is suitable habitat for these species within wetland and forest habitats.

The study area contains three EECs listed on the TSC Act:

- Lower Hunter Spotted Gum Ironbark Forest
- Hunter Lowland Redgum Forest
- Freshwater Wetland on Coastal Floodplains

Native vegetation within the study area occurs as isolated patches surrounded by cleared residential development, industry, sporting fields, rail and roads. These would all act as barriers to the movement of seed propagles in the locality. There are no habitat corridors connecting the vegetation at the site with other nearby patches of native vegetation. Large sections of the site have been highly modified through past clearing associated with quarrying activities and consequently the majority of vegetation within the site is in moderate to poor condition with moderate species diversity and patches that contain high densities of exotic species.

Despite the degraded nature of the site, remnant patches of EECs within the site still retain considerable conservation values as they provide important habitat for native plants and animals including potential threatened species. There is potential for these areas to be rehabilitated through weed management and revegetation works such that they would maintain their ecological functions.

4.2 Fauna

The site contains moderate quality forest and wetland habitat. Two threatened bats listed as vulnerable on the TSC Act and/or EPBC Act, Grey-headed Flying-fox and Little Bentwing-bat, were recorded onsite, and potential habitat for a range of other threatened bats, owls and Squirrel Glider occurs onsite. The site represents good quality foraging habitat for bats, owls, birds, reptiles and arboreal mammals. The limited number of hollow-bearing trees means the site has limited value as nesting and denning sites for hollow-dependant fauna such as birds, mammals and bats.

Wetlands onsite offer good quality habitat for amphibians, with permanent aquatic habitat including instream and fringing native vegetation, macrophytes, in stream woody debris, open water and connections to terrestrial habitats including rocky basking sites. However, the value of these wetlands for fauna is significantly decreased due to the presence of the introduced predatory Mosquito Fish.

Examination of recent aerial photos indicates that the site is an isolated pocket of remnant bushland surrounded by large-scale clearing for residential, infrastructure and rural land uses. Isolated canopy trees occur throughout residential areas of Metford, and would provide corridors for mobile wildlife (such as birds and bats) to larger areas of native vegetation at Ashtonfield. There are numerous existing barriers to fauna movement including the railway, golf course and playing fields to the north and east of the site, and residential areas south and west of the site.

An aquatic corridor extends along Two Mile Creek through the north east area of the site. Two Mile Creek flows north east and joins with Four Mile Creek approximately two kilometres north east of the site, however the riparian corridor along both Two Mile and Four Mile Creek has been largely cleared and is unlikely to be an important fauna movement corridor.

4.3 Key Threatening Processes

A key threatening process (KTP) is defined in the TSC Act (OEH 2012c) as an action, activity or proposal that:

- Adversely affects two or more threatened species, populations or ecological communities.
- Could cause species, populations or ecological communities that are not currently threatened to become threatened.

There are currently 36 KTPs listed under the TSC Act, seven listed under the FM Act and 19 under the EPBC Act. A number of KTPs are listed under more than one Act. KTPs currently operating at the site are summarised in Table 4-1.

Table 4-1 Key threatening processes

KTP	Status	Comment
Clearing of native vegetation	TSC Act; EPBC Act	Clearing of native vegetation has occurred historically within and around the study area. This has resulted in a variety of impacts on the remaining native vegetation including increased weed invasion due to soil disturbance and edge effects. This KTP is not affected by current land use.
Loss of hollow-bearing trees	TSC Act	Past clearing at the site is likely to have resulted in a loss of hollow bearing trees. At present the majority of the vegetation within the study area is relatively young with very few trees having a diameter at breast height (DBH) of greater than 40 cm. There are relatively few hollow-bearing trees onsite. This KTP is not affected by current land use.
Removal of dead wood and dead trees	TSC Act	Past clearing at the site is likely to have resulted in the removal of dead wood and dead trees. This KTP is not affected by current land use.
Invasion of plant communities by perennial exotic grasses	TSC Act	The site has been subject to historical disturbance and consequently there are a number of invasive exotic perennial grasses that have invaded areas of native vegetation. This KTP is likely to be exacerbated onsite without the implementation of weed management.
Invasion establishment and spread of Lantana camera	TSC Act	The site has been subject to historical disturbance and consequently Lantana has invaded extensive areas throughout the site. This KTP is likely to be exacerbated onsite without the implementation of weed management.

KTP	Status	Comment
The introduction of fish to freshwaters within a river catchment outside their natural range	FM Act	The introduced predatory Mosquito Fish occurs in creeks and dams onsite, significantly decreasing the value of fauna habitat for amphibians. Mosquito Fish are widespread within tributaries of the Hunter River. This KTP is not affected by current land use.

4.4 Recommendations

In order to maintain and enhance biodiversity values at the site it is recommended that a detailed site restoration plan be developed and implemented. This plan should contain site specific management actions for the control of noxious and environmental weeds at the site as well as a revegetation program for restoring vegetation in degraded and cleared areas, and along banks of wetlands.

Fauna conservation values at the site would be significantly enhanced through the installation of nest boxes. Next boxes would provide critical nesting and denning habitat for a range of fauna including bats, arboreal mammals and owls.

Should the future use of the site involve retention of part or all of the forest and woodland vegetation and aquatic habitats described in this report, the following management actions would be recommended:

- Dedicated weed control program, targeted Lantana and the more abundant environmental weeds;
- Targeted searches for cryptic orchids during their known flowering periods, with appropriate protection and management of any populations recorded
- Installation of nest boxes, suitably designed for forest birds (eg parrots), microchiropteran bats and small arboreal mammals (eg Squirrel Glider)
- Feral animal control, including rabbit warren destruction and fox baiting, in consultation with local National Parks and Wildlife Service programmes;
- Construction of appropriate access and signage, to promote public responsibility for, and enjoyment of, the retained bushland.

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6. Limitations

This report: has been prepared by GHD for APP Corporation and may only be used and relied on by APP Corporation for the purpose agreed between GHD and the APP Corporation as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than APP Corporation arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (Section 3.2.3). GHD disclaims liability arising from any of the assumptions being incorrect.

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The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

Appendices

Appendix A – Likelihood of occurrence

Table A-1 Threatened Biota known or Predicted from the Locality, Habitat Association and Likelihood of occurring at the Subject Site

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of Occurrence
EECs						
Central Hunter Ironbark-Spotted Gum-Grey Box Forest		EEC	-	Generally occurs on Permian sediments in the Hunter Valley and typically forms an open forest to woodland. It is dominated by *Eucalyptus crebra*, *Corymbia maculata* and *Eucalyptus moluccana*. Other tree species may be present and occasionally dominate or co-dominate, and include *Eucalyptus fibrosa* and *Eucalyptus tereticornis*. The Central Hunter Ironbark - Spotted Gum - Grey Box Forest has been recorded from the local government areas of Cessnock, Singleton and Muswellbrook but may occur elsewhere within the NSW North Coast and Sydney Basin Bioregions.	**Mapped** as occurring within 10 km (LHCCREMS 2003).	**Present**
Hunter Lowland Redgum Forest		EEC	-	Found on gentle slopes arising from depressions and drainage flats on Permian sediments of the Hunter Valley floor in the Sydney Basin and NSW North Coast Bioregions. It is generally an open forest with most common canopy trees species being *Eucalyptus tereticornis* and *Eucalyptus punctata.* The mid stratum is characterised as open with sparse shrubs of *Breynia oblongifolia*, *Leucopogon juniperinus*, *Daviesia ulicifolia* and *Jacksonia scoparia*. There is consistently a ground layer of grasses and herbs, characterised by *Microlaena stipoides* var. *stipoides*, *Cymbopogon refractus*, *Cheilanthes sieberi* subsp. *sieberi* and *Pratia purpurascens*. Has been recorded from the local government areas of Maitland, Cessnock and Port Stephens (in the Sydney Basin Bioregion) and Muswellbrook and Singleton.	**Mapped** as occurring within 10 km (LHCCREMS 2003).	**Present**
Swamp Sclerophyll forest on Coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions		EEC		Usually occurs below 20m asl (sometimes up to 50m). Associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Characterised by open to dense tree layer of eucalypts and paperbarks, with trees up to or higher than 25 m. Includes areas of fern land and tall reed or sedge land, where trees are sparse or absent.	**Mapped** as occurring within 10 km (LHCCREMS 2003). .	**Nil** - Community not identified during field surveys and considered unlikely to occur in the study area.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of Occurrence
Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions		EEC		Associated with coastal areas subject to periodic flooding and in which standing fresh water persists for at least part of the year in most years. Typically occurs on silts, muds or humic loams in low-lying parts of floodplains, alluvial flats, depressions, drainage lines, backswamps, lagoons and lakes but may also occur in backbarrier landforms where floodplains adjoin coastal sandplains. Generally occurs below 20 m elevation on level areas (DECC 2009a).	**Mapped** as occurring within 10 km (LHCCREMS 2005). .	**Present**
Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions		EEC		This community is found on the coastal floodplains of NSW. It has a dense to sparse tree layer in which Swamp Oak (*Casuarina glauca)* is the dominant species northwards from Bermagui. Associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains Generally occurs below 20 m (rarely above 10 m) elevation. The structure of the community may vary from open forests to low woodlands, scrubs or reedlands with scattered trees (DECC 2009a).	**Mapped** as occurring within 10 km (LHCCREMS 2003).	**Nil-** Community not identified during field surveys and considered unlikely to occur in the study area.
Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions		EEC		Coastal Saltmarsh is a mostly treeless plant community recognised by a mosaic of succulent herbs, salt tolerant grasses and sedges. The community is found in the tidal flats of estuaries and on edges of intermittently opened coastal lagoons. They are characterised by vegetation interspersed with unvegetated patches or salt pans. Coastal saltmarsh is one of a number of interrelated saltwater wetland habitats which includes seagrass beds, mangroves and swamp forests. Coastal Saltmarsh is found in the upper limits of the inter-tidal zone of coastal estuaries and saline or brackish lagoons	**Mapped** as occurring within 10 km (LHCCREMS 2003).	**Nil-** Community not identified during field surveys and considered unlikely to occur in the study area.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of Occurrence
Flora						
Acacia bynoeana	Bynoe's Wattle	E	V	Endemic to central eastern NSW, currently known from only 34 locations, many of only 1-5 plants. Grows mainly in heath/ dry sclerophyll forest on sandy soils, prefers open, sometimes slightly disturbed sites such as trail margins, road edges, and in recently burnt open patches. Flowers September- March.	**Recorded** within 10 km (OEH 2013).	**Unlikely** – suitable habitat not present within the study area.
Allocasuarina defungens	Dwarf Heath Casuarina	E	E	Confined to the north coast region of NSW, between Raymond Terrace and Port Macquarie. A small number of individuals have been located at Port Macquarie. Found in coastal areas of wet to dry, dense, low, closed heath land. Occurs in heath on sand, on clay soils and sandstone. The species also extends onto exposed nearby coastal hills or headlands adjacent to sandplains.	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** – suitable habitat not present within the study area.
Asterolasia elegans	-	E	E	Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby LGAs, may also occur in the western part of Gosford LGA. There are seven known populations. Occurs on Hawkesbury sandstone, commonly amongst rocky outcrops and boulders in sheltered forests on mid- to lower slopes and valleys. Flowering - Spring	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** – suitable habitat not present within the study area
Bothriochloa biloba	Lobed bluegrass	-	V	*B. biloba* is known from the Darling Downs district in Queensland, south along the western slopes of the Great Dividing Range to North Star, Warialda, Bingara and Merriwa in NSW. It also occurs west to Dubbo and around the Hunter Valley. It prefers heavier-textured soils such as brown or black clay soils. *B. biloba* grows in cleared eucalypt forests and relict grassland, often dominated by *Aristida ramosa, Bothriochloa macra, B. decipiens, Dichanthium sericeum* or *Austrostipa aristiglumis*. Dense stands of *B. biloba* have been recorded in *Chloris truncata* grassland in the north-western slopes of NSW (Bean 1999). Flowering - Summer	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** – suitable habitat not present within the study area

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of Occurrence
Callistemon linearifolius	-	V	-	This shrub has been recorded from the Georges River to Hawkesbury River in the Sydney area and north to the Nelson Bay area where it is known to occur in dry sclerophyll forest. Flowering- Spring-Summer	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** – suitable habitat not present within the study area
Cryptostylis hunteriana	Leafless Tongue Orchid	V	V	Occurs in coastal areas from East Gippsland in Victoria, through coastal NSW, to southern Queensland. In NSW this species is highly localised. Habitat preferences not well defined. Grows in a wide variety of habitats including coastal districts, heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and lowland forest. Prefers open areas in the understorey and is often found in association with *Cryptostylis subulata* and the *Cryptostylis erecta*. Flowering – December -February	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Possible** – Suitable habitat present in Spotted Gum Ironbark Forest and Lower Hunter Redgum Forest
Cymbidium canaliculatum	*Tiger Orchid*	EP		*C. canaliculatum* has a scattered distribution in northern and eastern Australia from northeast NSW, through Queensland and the Northern Territory to Western Australia. In NSW it occurs within dry sclerophyll forests and woodlands of tablelands and western slopes, growing in hollows of trees. The population of *C. canaliculatum* in the Hunter Catchment is at the south-eastern limit of the geographic range for this species (Peake 2006). In the Hunter Catchment *it* is known to occur within Wollemi and Goulburn River National Parks but it is estimated that about 90% of the population occurs on land not managed for conservation. Flowering – September -November	**Recorded** within 10 km (OEH 2013).	**Unlikely –** suitable habitat not present within the study area
Eucalyptus glaucina	Slaty Red Gum	V	V	Slaty Red Gum occurs in a variety of habitats including shallow soils, grassy woodlands on deep, moderately fertile soil and gentle slopes near drainage lines in clayey soil. It is only found on the north coast of NSW in two separate districts. It is found near Casino where it is locally common and further south from Taree to Broke and west of Maitland.	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Possible** – Suitable habitat present in Lower Hunter Redgum Forest

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of Occurrence
Eucalyptus parramattensis subsp. *parramattensis*		EP	-	The species usually occurs from the Goulburn Valley on the Central West slopes to Hill Top on the Central Coast. The endangered population in the Lake Macquarie and Wyong local government areas is at the north-eastern limit of the species range and is quite separate from other known populations. The majority of the population occurs within Wyong in the Porter's Creek and the Wallarah Creek catchments. This species is associated with low moist areas alongside drainage lines and adjacent to wetlands. It is often found in woodland on sandy soils. The endangered population occurs on sandy alluvium within a floodplain community which also supports *Eucalyptus robusta* (Swamp mahogany), *E. tereticornis* (Forest Red Gum), *Corymbia gummifera* (Red Bloodwood) as well as *Melaleuca* (Paperbark) species.	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** – suitable habitat present within the study area however conspicuous species that is likely to have been recorded during the field survey if present.
Euphrasia arguta		CE	CE	A semi –parasitic shrub that has recently been rediscovered near Nundle on the north-western slopes and tablelands, once known from scattered locations between Sydney, Bathurst and Walcha. Known populations occur in eucalypt forest with a mixed grass/shrub understorey, while previous records are described as occurring in open forest, grassy country and river meadows. Annual and dies back over winter. Dense stands observed in cleared firebreak areas, suggesting it may respond well to disturbance. Flowering –October-January	Predicted to occur within 10 km (DSEWPaC 2013).	**Unlikely**- suitable habitat not present within the study area.
Grevillea parviflora subsp. *parviflora*	Small-flower Grevillea	V	V	Occurs between Moss Vale/Bargo and lower Hunter Valley, with most occurrences in Appin, Wedderburn, Picton and Bargo. Broad habitat range including heath, shrubby woodland and open forest on light clay or sandy soils, and often in disturbed areas such as on the fringes of tracks. Flowering – July - December	**Recorded** within 10 km (OEH 2013).	**Unlikely** – suitable habitat present within the study area; however conspicuous species likely to have been recorded during field survey if present.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of Occurrence
Persicaria elatior	Knotweed	V	V	Knotweed is known from the North Coast, Central Coast and South Coast Botanical Subdivisions in New South Wales. Knotweed normally grows in damp places, including coastal with swampy areas, along watercourses, streams and lakes, swamp forest and disturbed areas.	Predicted to occur within 10 km (DSEWPaC 2013).	**Possible –** Suitable habitat present freshwater wetlands and artificial wetlands
Phaius australis	Lesser Swamp-orchid	E	E	Endemic to Australia and occurs in southern Queensland and northern NSW. Commonly associated with coastal wet heath/sedgeland wetlands, swampy grassland or swampy forest, and often where Broad-leaved Paperbark or Swamp Mahogany are found. Flowering– September - October	Predicted to occur within 10 km (DSEWPaC 2013).	**Unlikely**- suitable habitat not present within the study area.
Pterostylis gibbosa	Illawarra Greenhood	E	E	*P. gibbosa* is presently known from five locations: three subject sites in the Illawarra (two subject sites at Yallah and one at Albion Park); one subject site near Nowra in the Shoalhaven; and one subject site at Milbrodale in the Hunter Valley. *P. gibbosa* occurs on soils derived from Permian sedimentary rocks of the Berry formation at an altitude of 10 to 20 metres. Associated vegetation is woodland dominated by *Eucalyptus tereticornis* (Forest Red Gum) and *Melaleuca decora* (White Feather Honey-myrtle) with an open grassy understorey. Flowering– – August to November	Predicted to occur within 10 km (DSEWPaC 2013).	**Possible** – Suitable habitat present in Lower Hunter Redgum Forest
Maundia triglochinoides	-	V	-	*Maundia triglochinoides* is a rhizomatous perennial herb that grows in permanent swamps and wetlands on the central and north coasts of New South Wales. Flowering– during summer months	**Recorded** within 10 km (OEH 2013).	**Possible** – Suitable habitat present Freshwater Wetlands and artificial wetlands
Rutidosis heterogama	Heath Wrinklewort	V	V	Confined to the North Coast and Northern Tablelands regions of NSW. It is known from the Hunter Valley to Maclean, Wooli to Evans Head, and Torrington (Harden, 1992). Mostly inhabits heath, and is often found along disturbed roadsides (Harden, 1992). It occurs on moist sites in open forest and in sedgeland/heathland within shrubby open forest and woodland, at 860–1040 m above sea level.	**Recorded** within 10 km (OEH 2013).	**Unlikely** - suitable habitat not present within the study area.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of Occurrence
Streblus pendulinus (=Streblus brunonianus)	Siah's Backbone	-	E	Occurs in grassland or grassy woodland. Often found in damp sites in association with kangaroo grass. Found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands.	Predicted to occur within 10 km (DSEWPaC 2013).	**Unlikely**- suitable habitat not present within the study area.
Syzygium paniculatum	Magenta Lilly Pilly	E	V	Occurs in narrow coastal strip from Bulahdelah to Conjola State Forest. Grows in rainforest on sandy soils or stabilised Quaternary sand dunes at low altitudes in coastal areas, often in remnant littoral or gallery rainforests. Flowering– December- March	Predicted to occur within 10 km (DSEWPaC 2013).	**Unlikely-** suitable habitat not present within the study area.
Tetratheca juncea	Black-eyed Susan	V	V	Regarded as extinct within the Sydney area, current range from Wyong north to Bulahdelah and inland 50 km to edge of Sugarloaf Range. Occurs predominately in areas of over 1000 mm annual rainfall, within dry sclerophyll forest, and sometimes heath and moist forest, with a preference for Coastal Plains Smooth-barked Apple Woodland and Coastal Plains Scribbly Gum Woodland. Flowering– – July –December	**Recorded** within 10 km (OEH 2013).	**Possible** – Suitable habitat present in Spotted Gum Ironbark Forest

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of Occurrence
FAUNA						
Listed Threatened Birds						
Anseranas semipalmata	Magpie Goose	V	-	Occurs in the tropics, increasing numbers in central and northern NSW and vagrants to south-east NSW. Inhabits shallow wetlands containing dense rushes or sedges, and nearby dry land used for grazing. It feeds on grasses, bulbs and rhizomes and roosts in tall vegetation within wetland areas. Breeding is occurs predominately in monsoonal areas and is unlikely in SE NSW. Nests are formed in trees over deep water.	**Recorded** within 10km (OEH 2013)	**Possible** – Suitable habitat present Freshwater Wetlands and artificial wetlands
Anthochaera phrygia	Regent Honeyeater	CE	E	In NSW confined to two known breeding areas: the Capertee Valley and Bundarra-Barraba region. Non-breeding flocks occasionally seen in coastal areas foraging in flowering Spotted Gum and Swamp Mahogany forests, presumably in response to drought. Inhabits dry open forest and woodlands, particularly Box-Ironbark woodland and riparian forests of River Sheoak, with an abundance of mature trees, high canopy cover and abundance of mistletoes.	**Recorded** within 10 km (OEH 2013). **Predicted** to occur within 10 km (DSEWPAC 2013).	**Possible** – Suitable habitat present in Spotted Gum Ironbark Forest
Botaurus poiciloptilus	Australasian Bittern	E	E	Widespread but uncommon over most NSW except the north-west. Favours permanent freshwater wetlands with tall dense reedbeds particularly *Typha* spp. and *Eleocharis* spp., with adjacent shallow, open water for foraging. Roosts during the day amongst dense reeds or rushes and feeds mainly at night on frogs, fish, yabbies, spiders, insects and snails.	**Predicted** to occur within 10 km (DSEWPAC 2013).	**Possible** – Suitable habitat present Freshwater Wetlands and artificial wetlands
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	Sparsely distributed in areas of less than 500 mm rainfall, north from north-western NSW. Inhabits a range of inland habitats, especially along timbered watercourses which is the preferred breeding habitat. Also hunts over grasslands and sparsely timbered w	**Recorded** within 10km (OEH 2013)	**Unlikely** - suitable habitat not present within the study area

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of Occurrence
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	Widespread but uncommon from coast to southern tablelands and central western plains. Feeds almost exclusively on the seeds of Allocasuarina species. Prefers woodland and open forests, rarely away from Allocasuarina. Roost in leafy canopy trees, preferably eucalypts, usually <1km from feeding site. Nests in large (approx. 20 cm) hollows in trees, stumps or limbs, usually in Eucalypts (Higgins 1999).	**Recorded** within 10km (OEH 2013)	**Unlikely** - suitable habitat not present within the study area
Daphoenositta chrysoptera	Varied Sittella	V	-	Sedentary, occurs across NSW from the coast to the far west. Inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Sensitive to habitat isolation and loss of structural complexity, and adversely affected by dominance of Noisy Miners. Cleared agricultural land is potentially a barrier to movement. Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.	**Recorded** within 10km (OEH 2013)	**Unlikely** - suitable habitat not present within the study area
Dasyornis brachypterus	Eastern Bristlebird	E	E	Occurs in three disjunct areas of south-eastern Australia: southern Queensland/northern NSW, the Illawarra Region and in the vicinity of the NSW/Victorian border. Illawarra population comprises an estimated 1600 birds, mainly from Barren Grounds Nature Reserve, Budderoo National Park and the Jervis Bay area. Habitat characterised by dense, low vegetation including heath and open woodland with a heathy understorey. The fire history of habitat is important, and the Illawarra and southern populations reach maximum densities in habitat that have not been burnt for over 15 years.	**Predicted** to occur within 10 km (DSEWPAC 2013).	**Unlikely** - suitable habitat not present within the study area
Ephippiorhynchus asiaticus	Black-necked Stork	E	-	In NSW, becomes increasingly uncommon south of the Northern Rivers region, and rarely occurs south of Sydney. Breeding recorded as far south as Bulahdelah, though most breeding in NSW occurs in the north-east. Primarily inhabits permanent freshwater wetlands and surrounding vegetation including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters. Will also forage in inter-tidal shorelines, mangrove margins and estuaries. Feeds in shallow, still water. Breeds during summer, nesting in or near a freshwater swamp.	**Recorded** within 10km (OEH 2013)	**Likely –** numerous records nearby and suitable habitat present Freshwater Wetlands and artificial wetlands

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of Occurrence
Epthianura albifrons	White-fronted Chat	V	-	This species occurs from southern Queensland to Western Australia and down to Tasmania, mostly in temperate to arid climates and very rarely in sub-tropical areas. It is found in damp open habitats, particularly wetlands containing saltmarsh areas that are bordered by open grasslands. Along the coast they are found in estuarine and marshy habitats with vegetation <1m tall, and in open grasslands and areas bordering wetlands. Inland, they are often observed in grassy plains, saltlakes and saltpans along waterway margins.	**Recorded** within 10km (OEH 2013)	**Possible** – Suitable habitat present Freshwater Wetlands and artificial wetlands
Erythrotriorchis radiatus	Red Goshawk	CE	V	Typically occurs in coastal and subcoastal areas, with 90% of recent records in NSW confined to the Northern Rivers and Northern Tablelands regions, north of the Clarence River. Formerly occurred south to Port Stephens. Prefer woodlands and forests with a mosaic of vegetation types that are open enough for fast manoeuvring flight, avoiding very open or very dense habitats. In NSW inhabits mixed subtropical rainforest, Melaleuca swamp forest and open eucalypt forest along coastal rivers. Nests built within 1km of a permanent freshwater body in a large, tall tree(>20m) within a remnant stand. Home ranges large (120-200km2).	**Predicted to** occur within 10 km (DSEWPaC 2013).	**Possible** – Suitable foraging habitat present across the site
Glossopsitta pusilla	Little Lorikeet	V	-	Occurs from coast to western slopes of the Great Dividing Range. Inhabits dry, open eucalypt forests and woodlands. Occurrence is positively associated with patch size, and with components of habitat complexity including canopy cover, shrub cover, ground cover, logs, fallen branches and litter. Feed primarily on profusely-flowering eucalypts and a variety of other species including melaleucas and mistletoes. On the western slopes and tablelands *Eucalyptus albens* and *E. melliodora* are particularly important food sources for pollen and nectar respectively. Mostly nests in small (opening approx. 3cm) hollows in living, smooth-barked eucalypts, especially *Eucalyptus viminalis, E. blakelyi* and *E. dealbata*. Most breeding records are from the western slopes.	**Recorded** within 10km (OEH 2013)	**Unlikely** - suitable habitat not present within the study area
Hamirostra melanosternon	Black-breasted Buzzard	V	-	Sparsely distributed in areas of less than 500mm rainfall, north from north-western NSW .Inhabits a range of inland habitats, especially along timbered watercourses which is the preferred breeding habitat. Also hunts over grasslands and sparsely timbered woodlands. Breeds from August to October near water in a tall tree.	**Recorded** within 10km (OEH 2013)	**Possible** – Suitable habitat present Freshwater Wetlands and artificial wetlands

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of Occurrence
Hieraaetus morphnoides	Little Eagle	V	-	Occurs throughout NSW except most densely forested parts of the Dividing Range escarpment. Occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring.	**Recorded** within 10km (OEH 2013)	**Possible** – Suitable foraging habitat present across the site
Irediparra gallinacea	Comb-crested Jacana	V	-	Occurs on freshwater wetlands in northern and eastern Australia, mainly in coastal and subcoastal regions, from the north-eastern Kimberley Division of Western Australia to Cape York Peninsula then south along the east coast to the Hunter region of NSW – some recorded in south-eastern NSW potentially in response to unfavourable conditions (OEH 2012).	**Recorded** within 10km (OEH 2013)	**Possible** – Suitable habitat present across the site
Lathamus discolor	Swift Parrot	E	E	Migratory, travelling to the mainland from March to October. Breeds in Tasmania from September to January. On the mainland, it mostly occurs in the southeast foraging on winter flowering eucalypts and lerps, with records of the species between Adelaide and Brisbane.	**Recorded** within 10 km (OEH 2013). **Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** - suitable habitat not present within the study area
Lophoictinia isura	Square-tailed Kite	V	-	Occurs across NSW, resident in North, northeast and along west-flowing rivers. Summer breeding migrant to southeast of state. Inhabits a variety of habitats including woodlands and open forests, with preference for timbered watercourses. Favours productive forests on the coastal plain, box-ironbark-gum woodlands on the inland slopes, and Coolibah/River Red Gum on the inland plains. In Sydney area nests in mature living trees within 100m of ephemeral/permanent watercourse. Large home range > 100 km2.	**Recorded** within 10km (OEH 2013)	**Possible** – Suitable foraging habitat present across the site
Melithreptus gularis gularis	Black-chinned Honeyeater	V	-	Widespread in NSW, but rarely recorded east of Great Dividing Range except in Richmond and Clarence River areas and scattered sites in the Hunter, Central Coast and Illawarra regions. Mostly in upper levels of drier open forests /woodlands dominated by box and ironbark eucalypts, or less commonly smooth-barked gums, stringybarks and tea-treas. Forage over home range of >5 ha. Tend to occur within largest woodland patches in the landscape. They forage for insects, nectar and honeydew. The nest is hidden by foliage high in the crown of a tree.	**Recorded** within 10km (OEH 2013)	**Unlikely** - suitable habitat not present within the study area

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of Occurrence
Neophema pulchella	Turquoise Parrot	V	-	Occurs from coast to inland slopes. In coastal area, most common between Hunter and Northern Rivers, and further south in S Coast. Inhabits open eucalypt woodlands and forests, typically with a grassy understorey. Favours edges of woodlands adjoining grasslands or timbered creek lines and ridges. Feeds on the seeds of native and introduced grasses and other herbs. Grasslands and open areas provide important foraging habitat for this species while woodlands provide important roosting and breeding habitat. Nests in tree hollows, logs or posts from August to December.	**Recorded** within 10km (OEH 2013)	**Unlikely** - suitable habitat not present within the study area
Ninox connivens	Barking Owl	V	-	Occurs from coast to inland slopes and plains, though is rare in dense, wet forests east of the Great Dividing Range and sparse in higher parts of the tablelands and in the arid zone. Inhabits eucalypt woodlands, open forest, swamp woodlands, and, especially in inland areas, timber along watercourses. Roosts along creek lines in dense, tall understorey foliage (e.g. in Acacia and Casuarina), or dense eucalypt canopy. Nests in hollows of large, old eucalypts including Eucalyptus camaldulensis, Eucalyptus albens, Eucalyptus polyanthemos and Eucalyptus blakelyi. Birds and mammals important prey during breeding. Territories range from 30 to 200 hectares.	**Recorded** within 10km (OEH 2013)	**Unlikely** - suitable habitat not present within the study area
Ninox strenua	Powerful Owl	V	-	Occurs from the coast to the western slopes. Solitary and sedentary species. Inhabits a range of habitats from woodland and open sclerophyll forest to tall open wet forest and rainforest. Prefers large tracts of vegetation. Nests in large tree hollows (> 0.5 m deep), in large eucalypts (dbh 80-240 cm) that are at least 150 years old. Pairs have high fidelity to a small number of hollow-bearing nest trees and defend a large home range of 400 - 1,450 ha. Forages within open and closed woodlands as well as open areas.	**Recorded** within 10km (OEH 2013)	**Possible** – Suitable foraging habitat present across the site, potential nesting habitat within Spotted Gum Ironbark Forest
Oxyura australis	Blue-billed Duck	V	-	Partly migratory, travels short distances between breeding swamps and over-wintering lakes. Young birds disperse in April-May from breeding swamps in inland NSW to Murray River system and coastal lakes. Prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. Nests in Cumbungi over deep water or in trampled Lignum, sedges or spike-rushes. Completely aquatic, swimming along the edge of dense cover.	**Recorded** within 10km (OEH 2013)	**Possible** – Suitable habitat present Freshwater Wetlands and artificial wetlands

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of Occurrence
Pandion haliaetus	Eastern Osprey	V	M	Favours coastal areas, especially the mouths of large rivers, lagoons and lakes. They feed on fish over clear, open water. Breeding takes place from July to September in NSW, with nests being built high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.	**Recorded** within 10km (OEH 2013)	**Unlikely** - suitable habitat not present within the study area
Petroica boodang	Scarlet Robin	V	-	In NSW occurs from coast to inland slopes. Breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within open understorey of shrubs and grasses and sometimes in open areas. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. Abundant logs and coarse woody debris are important habitat components.	**Recorded** within 10km (OEH 2013)	**Unlikely** - suitable habitat not present within the study area
Pomatostomus temporalis temporalis	Grey-crowned Babbler	V	-	Occurs on western slopes and plains , as well as in the Hunter Valley and several locations on the north coast. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Family groups have territories between 1-50 (generally around 10) hectares. Nests typically built in shrubs or sapling eucalypts.	**Recorded** within 10km (OEH 2013)	**Possible** – Suitable habitat present in Spotted Gum Ironbark Forest
Ptilinopus regina	Rose-crowned Fruit-dove	V	-	Occurs from Newcastle north to Cape York, with vagrants occasionally as far south as Victoria. Occur mainly in sub-tropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful. Thought to be locally nomadic in response to fruit availability.	**Recorded** within 10km (OEH 2013)	**Unlikely** - suitable habitat not present within the study area
Rostratula benghalensis	Painted Snipe (was Australian Painted Snipe)	E	E, M	Normally found in permanent or ephemeral shallow inland wetlands, either freshwater or brackish. Nests on the ground amongst tall reed-like vegetation near water. Feeds on mudflats and the water's edge taking insects, worm and seeds. Prefers fringes of swamps, dams and nearby marshy areas with cover of grasses, lignum, low scrub or open timber.	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Possible** – Suitable habitat present Freshwater Wetlands and artificial wetlands
Stictonetta naevosa	Freckled Duck	V	-	Breeds in large, ephemeral swamps in the Murray-Darling, particularly along the Paroo and Lachlan Rivers and other Riverina rivers. In drier times moves to more permanent waters. Disperses during extensive inland droughts and may be found in coastal areas during such times. Prefers freshwater swamps/ccreeks with dense Cumbungi, Lignum or tea-tree. Nests in dense vegetation at or near water level.	**Recorded** within 10km (OEH 2013)	**Possible** – Suitable habitat present Freshwater Wetlands and artificial wetlands

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of Occurrence
Tyto novaehollandiae	Masked Owl	V	-	Occurs across NSW except NW corner. Most common on the coast. Inhabits dry eucalypt woodlands from sea level to 1100 m. Roosts and breeds in large (>40cm) hollows and sometime caves in moist eucalypt forested gullies. Hunts along the edges of forests and roadsides. Home range between 500 ha and 1000 ha. Prey mostly terrestrial mammals but arboreal species may also be taken.	**Recorded** within 10km (OEH 2013)	**Unlikely** - suitable habitat not present within the study area
Tyto tenebricosa	Sooty Owl	V	-	Occurs in the coastal, escarpment and tablelands regions of NSW. More common in the north and absent from the western tablelands and further west. Inhabits tall, moist eucalypt forests and rainforests, and are strongly associated with sheltered gullies, particularly those with tall rainforest understorey. Roosts in tree hollows, amongst dense foliage in gullies or in caves, recesses or ledges of cliffs or banks. Nest in large (>40cm wide, 100cm deep) tree hollows in unlogged/unburnt gullies within 100m of streams or in caves.	**Recorded** within 10km (OEH 2013)	**Unlikely** - suitable habitat not present within the study area
Listed Threatened Frogs						
Litoria aurea	Green and Golden Bell Frog	E	V	Occurs mainly along coastal lowland areas of eastern NSW and Victoria. The most northern extent of the species distribution is from Yuraygir National Park near Grafton on the North Coast of NSW while the most southern extent of the species' distribution is in the vicinity of Lake Wellington, just west of Lakes Entrance in south-eastern Victoria (White & Pyke 2008). In NSW, the species commonly occupies disturbed habitats, and breeds largely in ephemeral ponds. Inhabits many disturbed subject sites, including abandoned mines and quarries.	**Recorded** within 10 km (OEH 2013). **Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** - suitable habitat not present within the study area
Litoria littlejohni	Littlejohn's Tree Frog	V	V	Occurs on plateaus and eastern slopes of the Great Dividing Range south from Watagan State Forest. Occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops, hunting either in shrubs or on the ground.	**Recorded** within 10km (OEH 2013) **Predicted** to occur within 10km (DSEWPaC 2013)	**Unlikely** - suitable habitat not present within the study area

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of Occurrence
Mixophyes balbus	Stuttering Frog, Southern Barred Frog (in Victoria)	E	V	Occurs along the east coast of Australia. Has undergone a massive range reduction particularly in the south of its range: within the Sydney Basin, White (2008a) located only 3 populations south of Sydney (Macquarie Pass and Mt Werong) and Daly et al. (2002, in White 2008a) found only 2 extant populations between Macquarie Pass and Victoria. Inhabits rainforest and wet, tall, open forest. Shelter in deep leaf litter and thick understorey vegetation on the forest floor. Feeds on insects and smaller frogs, breeding in streams during summer after heavy rain. The species does not occur in areas where the riparian vegetation has been disturbed or where there have been significant upstream human impacts (Mahony et al 1997).	**Predicted** to occur within 10km (DSEWPaC 2013)	**Unlikely** - suitable habitat not present within the study area
Mixophyes iteratus	Giant Barred Frog	E	E	Occurs on the coast and ranges from south-eastern QLD to the Hawkesbury River in NSW, particularly in Coffs Harbour - Dorrigo area. Forage and live amongst deep, damp leaf litter in rainforest, moist eucalypt forest and nearby dry eucalypt forest. Breed in shallow, flowing rocky streams. Within Sydney Basin, confined to small populations in tall, wet forest in the Watagan Mountains north of the Hawkesbury and the lower Blue Mountains (White 2008b).	**Predicted** to occur within 10km (DSEWPaC 2013)	**Unlikely** - suitable habitat not present within the study area

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of Occurrence
Listed Threatened Mammals						
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Occurs from the coast to the western slopes of the divide. Largest numbers of records from sandstone escarpment country in the Sydney Basin and Hunter Valley (Hoye and Schulz 2008). Roosts in caves and mines and most commonly recorded from dry sclerophyll forests and woodlands. An insectivorous species that flies over the canopy or along creek beds (Churchill 2008). In southern Sydney appears to be largely restricted to the interface between sandstone escarpments and fertile valleys.	**Predicted** to occur within 10km (DSEWPaC 2013)	**Unlikely -** suitable habitat not present within the study area
Dasyurus maculatus	Spotted-tailed Quoll	V	E	Inhabits a range of environments including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Den sites are in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces. Females occupy home ranges of up to 750 ha and males up to 3,500 ha, usually traversed along densely vegetated creek lines.	**Recorded** within 10km (OEH 2013) **Predicted** to occur within 10km (DSEWPaC 2013)	**Unlikely** - suitable habitat not present within the study area
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	Occurs from the Shoalhaven north to the Queensland border. Now mostly extinct west of the Great Dividing Range, except in the Warrumbungles and Mt Kaputar. Occurs on rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. Diet consists of vegetation in adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees.	**Predicted** to occur within 10km (DSEWPaC 2013)	**Unlikely** - suitable habitat not present within the study area
Phascolarctos cinereus	Koala	V	V	Occurs from coast to inland slopes and plains. Restricted to areas of preferred feed trees in eucalypt woodlands and forests. Home range varies depending on habitat quality, from < 2 to several hundred hectares.	**Recorded** within 10km (OEH 2013) **Predicted** to occur within 10km (DSEWPaC 2013)	**Unlikely** - suitable habitat not present within the study area

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of Occurrence
Myotis macropus	Southern Myotis	V	-	Mainly coastal but may occur inland along large river systems. Usually associated with permanent waterways at low elevations in flat/undulating country, usually in vegetated areas. Forages over streams and watercourses feeding on fish and insects from the water surface. Roosts in a variety of habitats including caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage, typically in close proximity to water (Campbell 2011). Breeds November or December (Churchill 2008)	**Recorded** within 10km (OEH 2013)	**Likely** – Suitable roosting and foraging habitat present
Potorous tridactylus	Long-Nosed Potoroo	V	V	Restricted to east of the Great Dividing Range, with annual rainfall >760 mm. Inhabits coastal heath and dry and wet sclerophyll forests. Requires relatively thick ground cover and appears restricted to areas of light and sandy soil (Johnston 2008). Feeds on fungi, roots, tubers, insects and their larvae, and other soft-bodied animals in the soil.	**Predicted** to occur within 10km (DSEWPaC 2013)	**Unlikely** - suitable habitat not present within the study area
Pseudomys novaehollandiae	New Holland Mouse	-	V	Occurs in disjunct, coastal populations from Tasmania to Queensland. In NSW inhabits a variety of coastal habitats including heathland, woodland, dry sclerophyll forest with a dense shrub layer and vegetated sand dunes (Wilson and Bradtke 1999). Populations may recolonise/ increase in size in regenerating native vegetation after wildfire, clearing and sandmining. Presence strongly correlated with understorey vegetation density, and high floristic diversity in regenerating heath (Lock and Wilson 1999).	**Predicted** to occur within 10km (DSEWPaC 2013)	**Unlikely** - suitable habitat not present within the study area
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Roosts in camps within 20 km of a regular food source, typically in gullies, close to water and in vegetation with a dense canopy. Forages in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths, swamps and street trees, particularly in eucalypts, melaleucas and banksias. Highly mobile with movements largely determined by food availability (Eby and Law 2008). Will also forage in urban gardens and cultivated fruit crops.	**Recorded** within 10km (OEH 2013) **Predicted** to occur within 10km (DSEWPaC 2013)	**Present** – Sighted during fauna survey

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of Occurrence
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	Generally occurs east of the Great Dividing Range along NSW coast (Churchill 2008). Inhabits various habitats from open grasslands to woodlands, wet and dry sclerophyll forests and rainforest. Essentially a cave bat but may also roost in road culverts, stormwater tunnels and other man-made structures. Only 4 known maternity caves in NSW, near Wee Jasper, Bungonia, Kempsey and Texas. Females may travel hundreds of kilometres to the nearest maternal colony (Churchill 2008).	**Recorded** within 10km (OEH 2013)	**Likely** – Suitable roosting and foraging habitat present
Phascogale tapoatafa	Brush-tailed Phascogale	V	-	Predominately east of the Great Dividing Range, occasional records to the west. Prefers open forest with sparse groundcover but occurs in habitats ranging from mallees to rainforest. Home ranges span 20-40 ha (females) and >100 ha (males) though may be smaller in optimal habitats. Male ranges overlap with females and other males. May use up to 40 nests/ year in hollow trees, rotted stumps, buildings or bird nests. When breeding females prefer to nest in large tree cavities with small entrances. Forages preferentially in rough barked trees, large logs and dead standing trees (Soderquist and Rhind 2008).	**Recorded** within 10km (OEH 2013)	**Unlikely** - suitable habitat not present within the study area
Vespadelus troughtoni	Eastern Cave Bat	V	-	Occurs in NE NSW south to Kempsey and west to the Warrumbungles. Inhabits rainforest margins, wet and dry sclerophyll forests through to drier forests and woodlands in semi-arid environments. All records are within close proximity to sandstone or volcanic escarpments. Roosts in overhangs and caves, mines, boulder piles, abandoned Fairy Martin nests and occasionally in buildings, and regularly switches between alternate roost colonies. Forages over a small area, but are capable of flying 500 m over clear paddocks (Churchill 2008, Parnaby et al 2008).	**Recorded** within 10km (OEH 2013)	**Likely** – Suitable roosting and foraging habitat present
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	Occurs on southeast coast and ranges. Prefers tall (>20m) and wet forest with dense understorey. Absent from small remnants, preferring continuous forest but can move through cleared landscapes and may forage in open areas. Roosts in hollow trunks of Eucalypts, underneath bark or in buildings. Forages in gaps and spaces within forest, with large foraging range (12km foraging movements recorded) (Churchill 2008, Law et al 2008).	**Recorded** within 10km (OEH 2013)	**Unlikely** - suitable habitat not present within the study area
Mormopterus norfolkensis	Eastern Freetail-bat	V	-	Occurs in dry sclerophyll forest and woodland east of the Great Dividing Range. Forages in natural and artificial openings in vegetation, typically within a few kilometres of its roost. Roosts primarily in tree hollows but also recorded from man-made structures or under bark (Churchill 2008).	**Recorded** within 10km (OEH 2013	**Likely** – Suitable roosting and foraging habitat present

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of Occurrence
Petaurus norfolcensis	Squirrel Glider	V	-	Occurs along the drier inland slopes as well as coastal habitats. Inhabits woodland and open forest with a Eucalyptus, Corymbia or Angophora overstorey and a shrubby understorey of Acacia or Banksia. Key habitat components include reliable winter and early-spring flowering Eucalypts, Banksia or other nectar sources, and hollow-bearing trees for roost and nest sites (van der Ree and Suckling 2008, Quin et al 2004), with social groups moving between multiple hollows. Social groups include one or two adult males and females with offspring, and have home ranges of 5-10ha within NSW (van der Ree and Suckling 2008, Kavanagh 2004).	**Recorded** within 10km (OEH 2013)	**Possible** – Suitable habitat present in Spotted Gum Ironbark Forest
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	Occurs on the east coast and Great Dividing Range. Inhabits a variety of habitats from woodland to wet and dry sclerophyll forests and rainforest, also remnant paddock trees and timber-lined creeks, typically below 500m asl. Forages in relatively uncluttered areas, using natural or man-made openings in denser habitats. Usually roosts in tree hollows or fissures but also under exfoliating bark or in the roofs of old buildings. Females congregate in maternal roosts in suitable hollow trees (Hoye and Richards 2008, Churchill 2008).	**Recorded** within 10km (OEH 2013)	**Likely** – Suitable roosting and foraging habitat present
Miniopterus australis	Little Bentwing-bat	V	-	Occurs from Cape York to Sydney. Inhabits rainforests, wet and dry sclerophyll forests, paperbark swamps and vine thickets. Only one maternity cave known in NSW, shared with Eastern Bentwing-bats at Willi Willi, near Kempsey. Outside breeding season roosts in caves, tunnels and mines and has been recorded in a tree hollow on one occasion. Forages for insects beneath the canopy of well-timbered habitats (Churchill 2008, Hoye and Hall 2008).	**Recorded** within 10km (OEH 2013)	**Present –** call detected by ANABAT recording device.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Migrates from tropics to SE Aus in summer. Forages across a range of habitats including those with and without trees, from wet and dry sclerophyll forest, open woodland, Acacia shrubland, mallee, grasslands and desert. Roosts communally in large tree hollows and buildings (Churchill 2008).	**Recorded** within 10km (OEH 2013)	**Likely** – Suitable roosting and foraging habitat present

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of Occurrence
Listed Migratory Terrestrial Species						
Haliaeetus leucogaster	White-bellied Sea Eagle	-	M	Found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands. The habitats occupied by the sea-eagle are characterised by the presence of large areas of open water (larger rivers, swamps, lakes, the sea). Birds have been recorded in (or flying over) a variety of terrestrial habitats (Higgins 1999). The species is mostly recorded in coastal lowlands, but can occupy habitats up to 1400 m above sea level on the Northern Tablelands of NSW and up to 800 m above sea level in Tasmania and South Australia.	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Possible** – Suitable foraging habitat present across the site
Hirundapus caudacutus	White-throated Needletail	-	M	Almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. Because they are aerial, it has been stated that conventional habitat descriptions are inapplicable, but there are, nevertheless, certain preferences exhibited by the species. Although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland. They also commonly occur over heathland, but less often over treeless areas, such as grassland or swamps. When flying above farmland, they are more often recorded above partly cleared pasture, plantations or remnant vegetation at the edge of paddocks. In coastal areas, they are sometimes seen flying over sandy beaches or mudflats, and often around coastal cliffs and other areas with prominent updraughts, such as ridges and sand-dunes.	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** - suitable habitat not present within the study area

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of Occurrence
Merops ornatus	Rainbow Bee-eater	-	M	Occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation. It usually occurs in open, cleared or lightly-timbered areas that are often, but not always, located in close proximity to permanent water. It also occurs in inland and coastal sand dune systems, and in mangroves in northern Australia, and has been recorded in various other habitat types including heathland, sedgeland, vine forest and vine thicket, and on beaches. Occurs in open woodlands and shrublands, including mallee, and in open forests that are usually dominated by eucalypts. It also occurs in grasslands and, especially in arid or semi-arid areas, in riparian, floodplain or wetland vegetation assemblages.	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Possible** – Suitable habitat present in Spotted Gum Ironbark Forest
Monarcha melanopsis	Black-faced monarch	-	M	The Black-faced Monarch is found along the east coast and the eastern slopes of the Great Dividing Range from Cooktown, QLD, to the NSW/VIC border. Occurs in rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating.	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** - suitable habitat not present within the study area
Symposiarchus trivirgatus	Spectacled Monarch	-	M	The Spectacled Monarch is found in coastal north-eastern and eastern Australia, including coastal islands, from Cape York, Queensland to Port Stephens, New South Wales. It is much less common in the south. Prefers thick understorey in rainfprest, wet gullies and waterside vegetation as well as mangroves.		**Unlikely** - suitable habitat not present within the study area
Myiagra cyanoleuca	Satin Flycatcher	-	M	Mainly inhabit eucalypt forests, often near wetlands or watercourses. They have mainly been recorded in eucalypt forests, especially wet sclerophyll forest, often dominated by eucalypts such as Brown Barrel, *Eucalypt fastigata*, Mountain Gum, *E. dalrympleana*, Mountain Grey Gum, Narrow-leaved Peppermint, Messmate or Manna Gum, or occasionally Mountain Ash, *Eucalyptus regnans*. It is widespread in eastern Australia and vagrant to New Zealand.	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** - suitable habitat not present within the study area
Rhipidura rufifrons	Rufous fantail	-	M	Found along NSW coast and ranges. Inhabits rainforest, dense wet forests, swamp woodlands and mangroves. During migration, may be found in more open habitats or urban areas (Birds Australia 2008).	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** - suitable habitat not present within the study area

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of Occurrence
Listed Migratory Wetland Species						
Actitis hypoleucos	Common Sandpiper	-	M	Found along all coastlines of Australia and in many areas inland, the Common Sandpiper is widespread in small numbers. The population when in Australia is concentrated in northern and western Australia (Blakers et al. 1984; Higgins & Davies 1996).	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** - suitable habitat not present within the study area
Ardea ibis	Cattle Egret	-	M	Occurs across NSW. Principal breeding sites are the central east coast from Newcastle to Bundaberg. Also breeds in major inland wetlands in north NSW (notably the Macquarie Marshes). Occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. Uses predominately shallow, open and fresh wetlands with low emergent vegetation and abundant aquatic flora. Sometimes observed in swamps with tall emergent vegetation and commonly use areas of tall pasture in moist, low-lying areas.	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Possible** – Suitable habitat present Freshwater Wetlands and artificial wetlands
Ardea alba	Great Egret	-	M	Occurs across NSW. Within NSW there are breeding colonies within the Darling Riverine Plains and Riverina regions, and minor colonies across its range including the north and north-east of the state. Reported from a wide range of wetland habitats (for example inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial).	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Possible** – Suitable habitat present Freshwater Wetlands and artificial wetlands
Arenaria interpres	Ruddy Turnstone	-	M	The Ruddy Turnstone is widespread within Australia during its non-breeding period of the year (Bamford et al. 2008), including from Tasmania in the south to Darwin in the north and many coastal areas in between. It is found in most coastal regions, with occasional records of inland populations (Higgins & Davies 1996). It strongly prefers rocky shores or beaches where there are large deposits of rotting seaweed (C.D.T. Minton 2002, pers. comm.).	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** - suitable habitat not present within the study area
Calidris acuminata	Sharp-tailed Sandpiper	-	M	The Sharp-tailed Sandpiper spends the non-breeding season in Australia with small numbers occurring regularly in New Zealand. Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats. Many inland records are of birds on passage (Cramp 1985; Higgins & Davies 1996).	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** - suitable habitat not present within the study area

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of Occurrence
Calidris canutus	Red Knot	-	M	The Red Knot is common in all the main suitable habitats around the coast of Australia (Barrett et al. 2002b; Minton, C.D.T. 2002, pers. comm.; Watkins 1993) and is occasionally recorded inland.	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** - suitable habitat not present within the study area
Calidris ferruginea	Curlew Sandpiper	-	M	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Occasionally they are recorded around floodwaters (Higgins & Davies 1996).	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Possible** – Suitable habitat present Freshwater Wetlands and artificial wetlands
Calidris ruficollis	Red-necked Stint	-	M	The Red-necked Stint has been recorded in all coastal regions, and found inland in all states when conditions are suitable. The Red-necked Stint probably travels in flocks and has been observed to feed in dense flocks. The Australian population was estimated at 353 000 (Watkins 1993).	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** - suitable habitat not present within the study area
Calidris tenuirostris	Great Knot	-	M	The Great Knot has been recorded around the entirety of the Australian coast, with a few scattered records inland. It is now absent from some sites along the south coast where it used to be a regular visitor (Garnett et al. 2011). The greatest numbers are found in northern Australia; where the species is common on the coasts of the Pilbara and Kimberley, from the Dampier Archipelago to the Northern Territory border, and in the Northern Territory from Darwin and Melville Island, through Arnhem Land to the south-east Gulf of Carpentaria. Other important sites include the Broad Sound-Shoalwater Bay area, the Mackay region and Moreton Bay in Queensland.	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** - suitable habitat not present within the study area
Charadrius bicinctus	Double-banded Plover	-	M	The Double-banded Plover can be found in both coastal and inland areas. During the non-breeding season, it is common in eastern and southern Australia, mainly between the Tropic of Capricorn and western Eyre Peninsula, with occasional records in northern Queensland and Western Australia (Marchant & Higgins 1993).	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Possible** – Suitable habitat present Freshwater Wetlands and artificial wetlands

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of Occurrence
Charadrius leschenaultii	Great Sand Plover	-	M	In Australia, the Greater Sand Plover occurs in coastal areas in all states, though the greatest numbers occur in northern Australia, especially the north-west (Marchant & Higgins 1993; Minton et al. 2006).	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** - suitable habitat not present within the study area
Charadrius mongolus	Lesser Sand Plover	-	M	Within Australia, the Lesser Sand-Plover is widespread in coastal regions, and has been recorded in all states. It mainly occurs in northern and eastern Australia, in south-eastern parts of the Gulf of Carpentaria, western Cape York Peninsula and islands in Torres Strait, and along the entire east coast, though it occasionally also occurs inland.	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** - suitable habitat not present within the study area
Gallinago hardwickii	Latham's Snipe	--	M	Occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies). However, they can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to humans or human activity	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Possible** – Suitable habitat present Freshwater Wetlands and artificial wetlands
Tringa brevipes	Grey-tailed Tattler	-	M	In NSW the Grey-tailed Tattler is distributed along most of the coast from the Queensland border, south to Tilba Lake. It is more heavily distributed along coastal regions north of Sydney. The species is rarely recorded in Victoria, however sightings have been reported in Gippsland, and east of McLaughlans Beach. The largest populations in Victoria are located at Corner Inlet, west to Westernport and Port Phillip Bays. It has occasionally been sighted on the west coast near Killarney, Port Fairy and Discovery Bay. Sightings have also been reported at Sperm Whale Head (Higgins & Davies 1996).	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** - suitable habitat not present within the study area
Limicola falcinellus	Broad-billed Sandpiper	-	M	The Broad-billed Sandpiper is a regular visitor in small numbers to NSW, in coastal areas, from Ballina, south to Shoalhaven Heads. In Victoria, they are an annual visitor in small numbers in coastal regions, with rare inland records. In South Australia, single birds or a few have been recorded in ICI (St Kilda) Saltworks Buckland Park in most years, with few records elsewhere including Mutton Cove, Le Fevre Peninsula, Clinton Conservation Park, and Price Saltfields (Higgins & Davies 1996).	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** - suitable habitat not present within the study area

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of Occurrence
Limosa lapponica	Bar-tailed Godwit	-	M	The Bar-tailed Godwit has been recorded in the coastal areas of all Australian states. It is widespread in the Torres Strait and along the east and south-east coasts of Queensland, NSW and Victoria, including the offshore islands.	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** - suitable habitat not present within the study area
Numenius madagascariensis	Eastern Curlew	-	M	Within Australia, the Eastern Curlew has a primarily coastal distribution. The species is found in all states, particularly the north, east, and south-east regions including Tasmania. Eastern Curlews are rarely recorded inland.	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** - suitable habitat not present within the study area
Numenius phaeopus	Whimbrel	-	M	The Whimbrel is a regular migrant to Australia and New Zealand, with a primarily coastal distribution. There are also scattered inland records of Whimbrels in all regions. It is found in all states but is more common in the north.	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** - suitable habitat not present within the study area
Pluvialis fulva	Pacific Golden Plover	-	M	Within Australia, the Pacific Golden Plover is widespread in coastal regions, though there are also a number of inland records (in all states), sometimes far inland and usually along major river systems, especially the Murray and Darling Rivers and their tributaries. Most Pacific Golden Plovers occur along the east coast, and are especially widespread along the Queensland and NSW coastlines.	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** - suitable habitat not present within the study area
Pluvialis squatarola	Grey Plover	-	M	During the non-breeding season, the species is widespread on the coasts of North and South America, western and southern Europe, Africa, western, southern, south-eastern and eastern Asia, and Australia	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** - suitable habitat not present within the study area
Tringa stagnatilis	Marsh Sandpiper	-	M	The Marsh Sandpiper is found on coastal and inland wetlands throughout Australia. It is recorded in all regions of NSW but especially the central and south coasts and (inland) on the western slopes of Great Divide and western plains.	**Predicted** to occur within 10 km (DSEWPaC 2013).	**Unlikely** - suitable habitat not present within the study area

Species codes- V (vulnerable), E (endangered), M (migratory), CE (critically endangered), EEC (endangered ecological community), CEEC (critically endangered ecological community), EP (endangered population). Species associated with marine habitats alone have been omitted.

Appendix B – NSW Wildlife Atlas search results (threatened species)

Threatened Flora and Fauna Recorded from Locality (OEH 2013)

Kingdom	Class	Family	Scientific Name	Exotic	Common Name	NSW Status	Comm Status
Fauna	Aves	Procellariidae	*Pterodroma leucoptera leucoptera*		Gould's Petrel	V	E
Fauna	Mammalia	Dasyuridae	*Dasyurus maculatus*		Spotted-tailed Quoll	V	E
Fauna	Amphibia	Hylidae	*Litoria littlejohni*		Littlejohn's Tree Frog	V	V
Fauna	Mammalia	Phascolarctidae	*Phascolarctos cinereus*		Koala	V	V
Fauna	Mammalia	Pteropodidae	*Pteropus poliocephalus*		Grey-headed Flying-fox	V	V
Flora	Flora	Asteraceae	*Rutidosis heterogama*		Heath Wrinklewort	V	V
Flora	Flora	Elaeocarpaceae	*Tetratheca juncea*		Black-eyed Susan	V	V
Flora	Flora	Myrtaceae	*Eucalyptus glaucina*		Slaty Red Gum	V	V
Flora	Flora	Myrtaceae	*Eucalyptus parramattensis subsp. decadens*			V	V
Flora	Flora	Proteaceae	*Grevillea parviflora subsp. parviflora*		Small-flower Grevillea	V	V
Fauna	Aves	Anseranatidae	*Anseranas semipalmata*		Magpie Goose	V	
Fauna	Aves	Anatidae	*Oxyura australis*		Blue-billed Duck	V	
Fauna	Aves	Anatidae	*Stictonetta naevosa*		Freckled Duck	V	
Fauna	Aves	Columbidae	*Ptilinopus regina*		Rose-crowned Fruit-Dove	V	
Fauna	Aves	Accipitridae	*Hieraaetus morphnoides*		Little Eagle	V	
Fauna	Aves	Jacanidae	*Irediparra gallinacea*		Comb-crested Jacana	V	
Fauna	Aves	Psittacidae	*Glossopsitta pusilla*		Little Lorikeet	V	
Fauna	Aves	Meliphagidae	*Epthianura albifrons*		White-fronted Chat	V	
Fauna	Aves	Meliphagidae	*Melithreptus gularis gularis*		Black-chinned Honeyeater (eastern subspecies)	V	
Fauna	Aves	Pomatostomidae	*Pomatostomus temporalis temporalis*		Grey-crowned Babbler (eastern subspecies)	V	
Fauna	Aves	Neosittidae	*Daphoenositta chrysoptera*		Varied Sittella	V	
Fauna	Aves	Petroicidae	*Petroica boodang*		Scarlet Robin	V	
Fauna	Mammalia	Dasyuridae	*Phascogale tapoatafa*		Brush-tailed Phascogale	V	
Fauna	Mammalia	Petauridae	*Petaurus norfolcensis*		Squirrel Glider	V	

Kingdom	Class	Family	Scientific Name	Exotic	Common Name	NSW Status	Comm Status
Fauna	Mammalia	Emballonuridae	*Saccolaimus flaviventris*		Yellow-bellied Sheathtail-bat	V	
Fauna	Mammalia	Molossidae	*Mormopterus norfolkensis*		Eastern Freetail-bat	V	
Fauna	Mammalia	Vespertilionidae	*Falsistrellus tasmaniensis*		Eastern False Pipistrelle	V	
Fauna	Mammalia	Vespertilionidae	*Miniopterus australis*		Little Bentwing-bat	V	
Fauna	Mammalia	Vespertilionidae	*Miniopterus schreibersii oceanensis*		Eastern Bentwing-bat	V	
Fauna	Mammalia	Vespertilionidae	*Myotis macropus*		Southern Myotis	V	
Fauna	Mammalia	Vespertilionidae	*Scoteanax rueppellii*		Greater Broad-nosed Bat	V	
Fauna	Mammalia	Vespertilionidae	*Vespadelus troughtoni*		Eastern Cave Bat	V	
Flora	Flora	Juncaginaceae	*Maundia triglochinoides*			V	
Fauna	Aves	Cacatuidae	*Calyptorhynchus lathami*		Glossy Black-Cockatoo	V	
Fauna	Aves	Accipitridae	*Hamirostra melanosternon*		Black-breasted Buzzard	V	
Fauna	Aves	Accipitridae	*Lophoictinia isura*		Square-tailed Kite	V	
Fauna	Aves	Accipitridae	*Pandion cristatus*		Eastern Osprey	V	
Fauna	Aves	Cacatuidae	*Callocephalon fimbriatum*		Gang-gang Cockatoo	V	
Fauna	Aves	Psittacidae	*Neophema pulchella*		Turquoise Parrot	V	
Fauna	Aves	Strigidae	*Ninox connivens*		Barking Owl	V	
Fauna	Aves	Strigidae	*Ninox strenua*		Powerful Owl	V	
Fauna	Aves	Tytonidae	*Tyto novaehollandiae*		Masked Owl	V	
Fauna	Aves	Tytonidae	*Tyto tenebricosa*		Sooty Owl	V	
Flora	Flora	Myrtaceae	*Callistemon linearifolius*		Netted Bottle Brush	V	
Fauna	Aves	Scolopacidae	*Calidris ferruginea*		Curlew Sandpiper	E	M
Fauna	Aves	Laridae	*Sternula albifrons*		Little Tern	E	M
Fauna	Aves	Rostratulidae	*Rostratula australis*		Australian Painted Snipe	E	E
Fauna	Amphibia	Hylidae	*Litoria aurea*		Green and Golden Bell Frog	E	V
Flora	Flora	Fabaceae (Mimosoideae)	*Acacia bynoeana*		Bynoe's Wattle	E	V
Fauna	Aves	Ciconiidae	*Ephippiorhynchus asiaticus*		Black-necked Stork	E	
Fauna	Aves	Psittacidae	*Lathamus discolor*		Swift Parrot	E	E

Kingdom	Class	Family	Scientific Name	Exotic	Common Name	NSW Status	Comm Status
Flora	Flora	Orchidaceae	*Cymbidium canaliculatum*		Cymbidium canaliculatum population in the Hunter Catchment	E	
Fauna	Aves	Meliphagidae	*Anthochaera phrygia*		Regent Honeyeater	E	E
Fauna	Aves	Threskiornithidae	*Plegadis falcinellus*		Glossy Ibis		M
Fauna	Aves	Accipitridae	*Haliaeetus leucogaster*		White-bellied Sea-Eagle		M
Fauna	Aves	Ardeidae	*Ardea ibis*		Cattle Egret		M
Fauna	Aves	Apodidae	*Hirundapus caudacutus*		White-throated Needletail		M
Fauna	Aves	Scolopacidae	*Calidris acuminata*		Sharp-tailed Sandpiper		M
Fauna	Aves	Scolopacidae	*Calidris ruficollis*		Red-necked Stint		M
Fauna	Aves	Scolopacidae	*Gallinago hardwickii*		Latham's Snipe		M
Fauna	Aves	Scolopacidae	*Numenius minutus*		Little Curlew		M
Fauna	Aves	Scolopacidae	*Tringa glareola*		Wood Sandpiper		M
Fauna	Aves	Scolopacidae	*Tringa nebularia*		Common Greenshank		M
Fauna	Aves	Scolopacidae	*Tringa stagnatilis*		Marsh Sandpiper		M
Fauna	Aves	Laridae	*Chlidonias leucopterus*		White-winged Black Tern		M
Fauna	Aves	Procellariidae	*Ardenna pacificus*		Wedge-tailed Shearwater		M
Fauna	Aves	Meropidae	*Merops ornatus*		Rainbow Bee-eater		M
Fauna	Aves	Scolopacidae	*Calidris melanotos*		Pectoral Sandpiper		M

Key – V = vulnerable, E = endangered

Appendix C Protected matters search tool results

Australian Government

Department of Sustainability, Environment, Water, Population and Communities

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 16/08/13 14:43:26

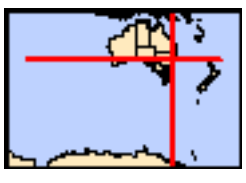
Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements

This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates

Buffer: 10.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	1
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	44
Listed Migratory Species:	43

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate.

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	7
Commonwealth Heritage Places:	1
Listed Marine Species:	48
Whales and Other Cetaceans:	1
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

Place on the RNE:	56
State and Territory Reserves:	2
Regional Forest Agreements:	1
Invasive Species:	47
Nationally Important Wetlands:	2
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

National Heritage Properties [Resource Information]

Name	State	Status
Historic		
St Peters Anglican Church Group	NSW	Nominated place

Wetlands of International Importance (RAMSAR) [Resource Information]

Name	Proximity
Hunter estuary wetlands	Within 10km of Ramsar

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat may occur within area
Diomedea exulans antipodensis Antipodean Albatross [82269]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans exulans Tristan Albatross [82337]	Endangered	Species or species habitat may occur within area
Diomedea exulans gibsoni Gibson's Albatross [82271]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Lathamus discolor		
Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Rostratula australis		
Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis		
Australian Fairy Tern [82950]	Vulnerable	Species or species habitat may occur within area
Fish		
Epinephelus daemelii		
Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Frogs		
Litoria aurea		
Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat likely to occur within area
Litoria littlejohni		
Littlejohn's Tree Frog, Heath Frog [64733]	Vulnerable	Species or species habitat may occur within area
Mixophyes balbus		
Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur within area
Mixophyes iteratus		
Giant Barred Frog, Southern Barred Frog [1944]	Endangered	Species or species habitat likely to occur within area
Mammals		
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat may occur within area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Petrogale penicillata		
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus		
Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat may occur within area
Pseudomys novaehollandiae		
New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat known to occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Plants		
Acacia bynoeana		
Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat likely to occur within area
Allocasuarina defungens		
Dwarf Heath Casuarina [21924]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Asterolasia elegans [56780]	Endangered	Species or species habitat likely to occur within area
Bothriochloa biloba Lobed Blue-grass [3153]	Vulnerable	Species or species habitat may occur within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus glaucina Slaty Red Gum [5670]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus parramattensis subsp. decadens Earp's Gum, Earp's Dirty Gum [56148]	Vulnerable	Species or species habitat likely to occur within area
Euphrasia arguta [4325]	Critically Endangered	Species or species habitat may occur within area
Grevillea parviflora subsp. parviflora Small-flower Grevillea [64910]	Vulnerable	Species or species habitat likely to occur within area
Persicaria elatior Knotweed [5831]	Vulnerable	Species or species habitat likely to occur within area
Phaius australis Lesser Swamp-orchid [5872]	Endangered	Species or species habitat may occur within area
Pterostylis gibbosa Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat may occur within area
Rutidosis heterogama Heath Wrinklewort [13132]	Vulnerable	Species or species habitat likely to occur within area
Streblus pendulinus Siah's Backbone, Sia's Backbone, Isaac Wood [21618]	Endangered	Species or species habitat likely to occur within area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Pocket-less Brush Cherry, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat likely to occur within area
Tetratheca juncea Black-eyed Susan [21407]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
[Natator depressus](#)		
Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
[Apus pacificus](#)		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
[Diomedea antipodensis](#)		
Antipodean Albatross [64458]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
[Diomedea dabbenena](#)		
Tristan Albatross [66471]	Endangered*	Species or species habitat may occur within area
[Diomedea exulans (sensu lato)](#)		
Wandering Albatross [1073]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
[Diomedea gibsoni](#)		
Gibson's Albatross [64466]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
[Caretta caretta](#)		
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
[Chelonia mydas](#)		
Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
[Dermochelys coriacea](#)		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
[Eretmochelys imbricata](#)		
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
[Natator depressus](#)		
Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
[Sousa chinensis](#)		
Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
[Haliaeetus leucogaster](#)		
White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
[Hirundapus caudacutus](#)		
White-throated Needletail [682]		Species or species habitat known to occur within area
[Merops ornatus](#)		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
[Monarcha melanopsis](#)		
Black-faced Monarch [609]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Xanthomyza phrygia Regent Honeyeater [430]	Endangered*	Foraging, feeding or related behaviour likely to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]		Species or species habitat known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]		Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]		Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Limicola falcinellus		
Broad-billed Sandpiper [842]		Species or species habitat known to occur within area
Limosa lapponica		
Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa		
Black-tailed Godwit [845]		Species or species habitat known to occur within area
Numenius madagascariensis		
Eastern Curlew [847]		Species or species habitat known to occur within area
Numenius phaeopus		
Whimbrel [849]		Species or species habitat known to occur within area
Pluvialis fulva		
Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Pluvialis squatarola		
Grey Plover [865]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Tringa stagnatilis		
Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area
Xenus cinereus		
Terek Sandpiper [59300]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Commonwealth Land - Airservices Australia
Commonwealth Land - Australian Postal Commission
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Defence Housing Authority
Commonwealth Land - Director of Defence Service Homes
Commonwealth Land - Director of War Service Homes

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Historic		
Maitland Post Office	NSW	Listed place

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]		Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]		Species or species habitat known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]		Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]		Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered*	Species or species habitat may occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
[Haliaeetus leucogaster](#) White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
[Heteroscelus brevipes](#) Grey-tailed Tattler [59311]		Species or species habitat known to occur within area
[Himantopus himantopus](#) Black-winged Stilt [870]		Species or species habitat known to occur within area
[Hirundapus caudacutus](#) White-throated Needletail [682]		Species or species habitat known to occur within area
[Lathamus discolor](#) Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
[Limicola falcinellus](#) Broad-billed Sandpiper [842]		Species or species habitat known to occur within area
[Limosa lapponica](#) Bar-tailed Godwit [844]		Species or species habitat known to occur within area
[Limosa limosa](#) Black-tailed Godwit [845]		Species or species habitat known to occur within area
[Merops ornatus](#) Rainbow Bee-eater [670]		Species or species habitat may occur within area
[Monarcha melanopsis](#) Black-faced Monarch [609]		Species or species habitat known to occur within area
[Monarcha trivirgatus](#) Spectacled Monarch [610]		Species or species habitat known to occur within area
[Myiagra cyanoleuca](#) Satin Flycatcher [612]		Species or species habitat known to occur within area
[Numenius madagascariensis](#) Eastern Curlew [847]		Species or species habitat known to occur within area
[Numenius phaeopus](#) Whimbrel [849]		Species or species habitat known to occur within area
[Pandion haliaetus](#) Osprey [952]		Species or species habitat known to occur within area
[Philomachus pugnax](#) Ruff (Reeve) [850]		Species or species habitat known to occur within area
[Pluvialis fulva](#) Pacific Golden Plover [25545]		Species or species habitat known to occur within area
[Pluvialis squatarola](#) Grey Plover [865]		Species or species habitat known to occur

Name	Threatened	Type of Presence
		within area
Recurvirostra novaehollandiae		
Red-necked Avocet [871]		Species or species habitat known to occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Tringa stagnatilis		
Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area
Xenus cinereus		
Terek Sandpiper [59300]		Species or species habitat known to occur within area
Reptiles		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Sousa chinensis		
Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area

Extra Information

Places on the RNE [Resource Information]

Note that not all Indigenous sites may be listed.

Name	State	Status
Natural		
Davids Cutting	NSW	Registered
Hunter Estuary Wetlands	NSW	Registered
Largs Raised Beach Geological Site	NSW	Registered
Historic		
Berry House	NSW	Indicative Place
Bourke Street Conservation Area	NSW	Indicative Place
Caroline Chisholm Barracks (former)	NSW	Indicative Place
Cemetery	NSW	Indicative Place
East Maitland Railway Station Group	NSW	Indicative Place

Name	State	Status
Grandstand and McDonald Pavilion	NSW	Indicative Place
Lorn House	NSW	Indicative Place
Maitland Showground	NSW	Indicative Place
Matthew Talbot Hostel (former)	NSW	Indicative Place
South Maitland Railway Companys Workshops	NSW	Indicative Place
Tarro Pumping Station	NSW	Indicative Place
Bond Stores Group (former)	NSW	Registered
Brough House	NSW	Registered
Burial Ground and Surrounds, Glebe Gully	NSW	Registered
Cintra Gardens	NSW	Registered
Cintra and Stables	NSW	Registered
Closebourne House	NSW	Registered
Dunmore Bridge	NSW	Registered
Dunmore House	NSW	Registered
East Maitland Courthouse Group	NSW	Registered
East Maitland Police Station (former)	NSW	Registered
East Maitland Post Office (former)	NSW	Registered
Fosters Farm and Outbuildings	NSW	Registered
Grossmann House	NSW	Registered
Grossmann House Group	NSW	Registered
High School (former) & RJ Hinder Memorial Library	NSW	Registered
Hinton Bridge	NSW	Registered
Lands Board Office	NSW	Registered
Maitland Courthouse	NSW	Registered
Maitland Post Office	NSW	Registered
Morpeth Museum & Library, former Courthouse	NSW	Registered
Morpeth Road Bridge	NSW	Registered
Morpeth Township	NSW	Registered
Oldholme and Garden	NSW	Registered
Police Station	NSW	Registered
Police Station (former)	NSW	Registered
Presbyterian Church Group	NSW	Registered
Primitive Methodist Church (former)	NSW	Registered
Railway Station (former)	NSW	Registered
Rose Inn (former)	NSW	Registered
Roseneath	NSW	Registered
St Mary the Virgin Anglican Church & Rectory	NSW	Registered
St Pauls Anglican Church & Bell Tower	NSW	Registered
St Pauls Anglican Church Group	NSW	Registered
St Peters Anglican Church	NSW	Registered
St Peters Anglican Parish Hall	NSW	Registered
St Peters Curates Residence	NSW	Registered
Technical College (former)	NSW	Registered
The Family Hotel	NSW	Registered
Victoria Hotel	NSW	Registered
Walka Waterworks and Pumping Station	NSW	Registered
Walli House Group	NSW	Registered
Walli House and Outbuildings	NSW	Registered

State and Territory Reserves [Resource Information]

Name	State
Hunter Wetlands	NSW
Pambalong	NSW

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Bufo marinus Cane Toad [1772]		Species or species habitat likely to occur within area
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom,		Species or species

Name	Status	Type of Presence
Common Broom, French Broom, Soft Broom [20126]		habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Protasparagus plumosus Climbing Asparagus-fern, Ferny Asparagus [11747]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Hexham Swamp	NSW
Shortland Wetlands Centre	NSW

Coordinates

-32.755745 151.606721,-32.763036 151.615304,-32.761015 151.601228,-32.755962 151.606893,-32.755745 151.606721

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix D Species recorded on site

Flora Species Recorded within the Study area

Family	Scientific Name	Common Name	Exotic
Adiantaceae	*Cheilanthes sieberi subsp. sieberi*	Rock Fern	
Anthericaceae	*Laxmannia gracilis*	Slender Wire Lily	
Apiaceae	*Ageratina adenophora*		
Apiaceae	*Hydrocotyle bonariensis*		*
Apiaceae	*Hydrocotyle peduncularis*		
Apiaceae	*Hydrocotyle tripartita*	Pennywort	
Apocynaceae	*Gomphocarpus fruticosus*	Narrow-leaved Cotton Bush	*
Apocynaceae	*Marsdenia australis*	Doubah	
Apocynaceae	*Parsonsia straminea*	Common Silkpod	
Asparagaceae	*Asparagus aethiopicus*	Asparagus Fern	*
Asteraceae	*Ambrosia tenuifolia*	Lacy Ragweed	*
Asteraceae	*Bidens pilosa*	Cobbler's Pegs	*
Asteraceae	*Cassinia aculeata*	Dolly Bush	
Asteraceae	*Chrysanthemoides monilifera*	Boneseed	*
Asteraceae	*Chrysocephalum apiculatum*	Common Everlasting	
Asteraceae	*Cirsium vulgare*	Spear Thistle	*
Asteraceae	*Hypochaeris radicata*	Catsear	*
Asteraceae	*Osteospermum fruticosum*		*
Asteraceae	*Ozothamnus diosmifolius*	White Dogwood	
Asteraceae	*Senecio madagascariensis*	Fireweed	*
Asteraceae	*Senecio pterophorus*		*
Bignoniaceae	*Pandorea pandorana*	Wonga Wonga Vine	
Campanulaceae	*Wahlenbergia gracilis*	Sprawling Bluebell	
Caprifoliaceae	*Lonicera japonica*	Japanese Honeysuckle	*
Caryophyllaceae	*Chloris gayana*	Rhodes Grass	*
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak	
Casuarinaceae	*Casuarina glauca*	Swamp Oak	
Chenopodiaceae	*Einadia nutans*	Climbing Saltbush	
Convolvulaceae	*Convolvulus erubescens*		
Convolvulaceae	*Dichondra repens*	Kidney Weed	
Crassulaceae	*Bryophyllum delagoense*	Mother of millions	*
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge	
Cyperaceae	*Ptilothrix deusta*		
Cyperaceae	*Eleocharis sphacelata*	Tall Spike Rush	
Cyperaceae	*Cyperus exaltatus*		
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-sedge	
Dennstaedtiaceae	*Histiopteris incisa*	Bat's Wing Fern	
Dilleniaceae	*Hibbertia fasciculata*		
Ericaceae	*Lissanthe strigosa*	Peach Heath	
Euphorbiaceae	*Ricinus communis*	Castor Oil Plant	*
Fabaceae (Faboideae)	*Daviesia ulicifolia*	Gorse Bitter Pea	
Fabaceae (Faboideae)	*Dillwynia retorta*		
Fabaceae (Faboideae)	*Glycine clandestina*	Twining glycine	

Family	Scientific Name	Common Name	Exotic
Fabaceae (Faboideae)	*Glycine tabacina*	Variable Glycine	
Fabaceae (Faboideae)	*Hardenbergia violacea*	False Sarsaparilla	
Fabaceae (Faboideae)	*Indigofera australis*	Australian Indigo	
Fabaceae (Faboideae)	*Pultenaea retusa*		
Fabaceae (Faboideae)	*Pultenaea spinosa*	A Bush Pea	
Fabaceae (Faboideae)	*Pultenaea spp.*		
Fabaceae (Faboideae)	*Trifolium repens*	White Clover	*
Fabaceae (Faboideae)	*Vicia sativa*	Common vetch	*
Fabaceae (Mimosoideae)	*Acacia brownii*	Heath Wattle	
Fabaceae (Mimosoideae)	*Acacia elongata*	Swamp Wattle	
Fabaceae (Mimosoideae)	*Acacia falcata*		
Fabaceae (Mimosoideae)	*Acacia parvipinnula*	Silver-stemmed Wattle	
Geraniaceae	*Geranium solanderi*	Native Geranium	
Goodeniaceae	*Goodenia hederacea*	Ivy Goodenia	
Goodeniaceae	*Goodenia rotundifolia*		
Haloragaceae	*Gonocarpus tetragynus*	Poverty Raspwort	
Iridaceae	*Freesia spp.*	Freesia	*
Juncaceae	*Juncus acutus subsp. acutus*	Sharp Rush	*
Juncaceae	*Juncus usitatus*	Common Rush	
Lobeliaceae	*Pratia purpurascens*	Whiteroot	
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush	
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush	
Lomandraceae	*Lomandra multiflora subsp. multiflora*	Many-flowered Mat-rush	
Loranthaceae	*Amyema spp.*	Mistletoe	
Malvaceae	*Modiola caroliniana*	Red-flowered Mallow	*
Malvaceae	*Sida rhombifolia*	Paddy's Lucerne	*
Myrsinaceae	*Anagallis arvensis*	Scarlet Pimpernel	*
Myrtaceae	*Angophora floribunda*	Rough-barked Apple	
Myrtaceae	*Corymbia maculata*	Spotted Gum	
Myrtaceae	*Eucalyptus agglomerata*	Blue-leaved Stringybark	
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark	
Myrtaceae	*Eucalyptus fibrosa*	Red Ironbark	
Myrtaceae	*Eucalyptus punctata*	Grey Gum	
Myrtaceae	*Eucalyptus siderophloia*	Grey Ironbark	
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum	
Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved Tea Tree	
Myrtaceae	*Sannantha pluriflora*		
Oleaceae	*Ligustrum lucidum*	Large-leaved Privet	*
Oleaceae	*Ligustrum sinense*	Small-leaved Privet	*
Oleaceae	*Olea europaea subsp. cuspidata*	African Olive	*
Oleracea	*Notelaea microcarpa var.*		

Family	Scientific Name	Common Name	Exotic
	microcarpa		
Onagraceae	*Ludwigia peploides subsp. montevidensis*	Water Primrose	
Orchidaceae	*Caladenia carnea*	Pink Fingers	
Orchidaceae	*Cryptostylis spp.*		
Oxalidaceae	*Oxalis perennans*		
Philydraceae	*Philydrum lanuginosum*	Frogsmouth	
Phormiaceae	*Dianella caerulea*	Blue Flax-lily	
Phormiaceae	*Dianella revoluta var. revoluta*	A Blue Flax Lily	
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush	
Phyllanthaceae	*Glochidion ferdinandi*	Cheese Tree	
Phyllanthaceae	*Phyllanthus hirtellus*	Thyme Spurge	
Pittosporaceae	*Bursaria spinosa*	Native Blackthorn	
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum	
Plantaginaceae	*Plantago lanceolata*	Lamb's Tongues	*
Poaceae	*Aristida sp*	Threeawn grass	
Poaceae	*Aristida vagans*	Threeawn Speargrass	
Poaceae	*Briza maxima*	Quaking Grass	*
Poaceae	*Briza subaristata*		*
Poaceae	*Cortaderia spp.*		*
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass	
Poaceae	*Cynodon dactylon*	Common Couch	
Poaceae	*Dichelachne micrantha*	Shorthair Plumegrass	
Poaceae	*Dichelachne spp.*	A Plumegrass	
Poaceae	*Echinopogon ovatus*	Forest Hedgehog Grass	
Poaceae	*Ehrharta longiflora*	Annual Veldtgrass	*
Poaceae	*Entolasia stricta*	Wiry Panic	
Poaceae	*Eragrostis brownii*	Brown's Lovegrass	
Poaceae	*Hyparrhenia hirta*	Coolatai Grass	*
Poaceae	*Imperata cylindrica*	Blady Grass	
Poaceae	*Joycea pallida*	Silvertop Wallaby Grass	
Poaceae	*Melinis repens*	Red Natal Grass	*
Poaceae	*Microlaena stipoides*	Weeping Grass	
Poaceae	*Panicum maximum var maximum*		*
Poaceae	*Paspalum dilatatum*	Paspalum	*
Poaceae	*Pennisetum clandestinum*	Kikuyu Grass	*
Poaceae	*Phragmites australis*	Common Reed	
Poaceae	*Rhytidosperma spp.*	Wallaby Grass	
Poaceae	*Sporobolus creber*	Slender Rat's Tail Grass	
Poaceae	*Themeda australis*	Kangaroo Grass	
Poaceae	*Paspalum distichum*	Water Couch	
Poaceae	*Cortaderia selloana*	Pampas Grass	*
Polygonaceae	*Persicaria decipiens*	Slender Knotweed	
Polygonaceae	*Rumex crispus*	Curled Dock	*

Family	Scientific Name	Common Name	Exotic
Proteaceae	*Grevillea robusta*	Silky Oak	
Ranunculaceae	*Clematis aristata*	Old Man's Beard	
Ranunculaceae	*Clematis glycinoides*	Headache Vine	
Rosaceae	*Rubus fruticosus sp. agg.*	Blackberry complex	*
Rubiaceae	*Pomax umbellata*	Pomax	
Santalaceae	*Exocarpos cupressiformis*	Cherry Ballart	
Stylidiaceae	*Stylidium graminifolium*	Grass Triggerplant	
Thymelaeaceae	*Pimelea curviflora*	Rice Flower	
Typhaceae	*Typha orientalis*	Broad-leaved Cumbungi	
Verbenaceae	*Lantana camara*	Lantana	*
Verbenaceae	*Verbena bonariensis*	Purpletop	*
Violaceae	*Viola hederacea*	Ivy-leaved Violet	

Fauna Species Recorded within the Study Area

Class	Family	Exotic	Scientific Name	Common Name	TSC Status	EPBC Status	GHD 2013
Amphibia	Myobatrachidae		*Crinia signifera*	Common Eastern Froglet			
Amphibia	Myobatrachidae		*Limnodynastes tasmaniensis*	Spotted Grass Frog			X
Aves	Anatidae		*Anas superciliosa*	Pacific Black Duck			X
Aves	Anatidae		*Chenonetta jubata*	Australian Wood Duck			X
Aves	Pachycephalidae		*Colluricincla harmonica*	Grey Shrike-thrush			X
Aves	Campephagidae		*Coracina novaehollandiae*	Black-faced Cuckoo-shrike			X
Aves	Corvidae		*Corvus coronoides*	Australian Raven			X
Aves	Corvidae		*Corvus mellori*	Little Raven			X
Aves	Podicipididae		*Tachybaptus novaehollandiae*	Australasian Grebe			X
Aves	Artamidae		*Cracticus nigrogularis*	Pied Butcherbird			X
Aves	Artamidae		*Cracticus tibicen*	Australian Magpie			X
Aves	Artamidae		*Cracticus torquatus*	Grey Butcherbird			X
Aves	Alcedinidae		*Dacelo novaeguineae*	Laughing Kookaburra			X
Aves	Ardeidae		*Egretta novaehollandiae*	White-faced Heron			X
Aves	Ardeidae		*Egretta garzetta*	Little Egret			X
Aves	Accipitridae		*Elanus axillaris*	Black-shouldered Kite			X
Aves	Cacatuidae		*Eolophus roseicapillus*	Galah			X
Aves	Columbidae		*Geopelia striata*	Peaceful Dove			X
Aves	Monarchidae		*Grallina cyanoleuca*	Magpie-lark			X
Aves	Hirundinidae		*Hirundo neoxena*	Welcome Swallow			X
Aves	Maluridae		*Malurus cyaneus*	Superb Fairy-wren			X
Aves	Maluridae		*Malurus lamberti*	Variegated Fairy-wren			X
Aves	Meliphagidae		*Manorina melanocephala*	Noisy Miner			X
Aves	Estrildidae		*Neochmia temporalis*	Red-browed Finch			X

Class	Family	Exotic	Scientific Name	Common Name	TSC Status	EPBC Status	GHD 2013
Aves	Columbidae		*Ocyphaps lophotes*	Crested Pigeon			X
Aves	Meliphagidae		*Phylidonyris niger*	White-cheeked Honeyeater			X
Aves	Psittacidae		*Platycercus eximius*	Eastern Rosella			X
Aves	Rallidae		*Porphyrio porphyria*	Purple Swamphen			X
Aves	Rallidae		*Fulica atra*	Eurasian Coot			X
Aves	Rhipiduridae		*Rhipidura albiscapa*	Grey Fantail			X
Aves	Rhipiduridae		*Rhipidura leucophrys*	Willie Wagtail			X
Aves	Sturnidae	*	*Sturnus tristis**	Common Myna			X
Aves	Threskiornithidae		*Platalea regia*	Royal Spoonbill			X
Mammalia	Leporidae	*	*Oryctolagus cuniculus**	Rabbit			X
Mammalia	Macropodidae		*Macropod sp.*	unidentified macropod			X
Mammalia	Pteropodidae		*Pteropus poliocephalus*	Grey-headed Flying-fox			X
Mammalia	Vespertilionidae		*Chalinolobus morio*	Chocolate Wattled Bat			SG
Mammalia	Vespertilionidae		*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V		SG
Mammalia	Vespertilionidae		*Miniopterus australis*	Little Bentwing-bat	V		X
Mammalia	Vespertilionidae		*Miniopterus orianae subsp. oceanensis*	Eastern Bentwing-bat	V		SG
Mammalia	Vespertilionidae		*Nyctophilus sp.*	long-eared bat			X
Mammalia	Vespertilionidae		*Scoteanax rueppellii*	Greater Broad-nosed Bat	V		SG
Mammalia	Vespertilionidae		*Scotorepens orion*	Eastern Broad-nosed Bat			SG
Mammalia	Vespertilionidae		*Vespadelus vulturnus*	Little Forest Bat			SG
Mammalia	Vespertilionidae		*Vespadelus pumilus*	Eastern Forest Bat			X
Mammalia	Vespertilionidae		*Vespadelus troughtoni*	Eastern Cave Bat	V		SG
Mammalia	Vespertilionidae		*Vespadelus sp.*	Unidentified Eptesicus			SG

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FLORA AND FAUNA ASSESSMENT

"the old brickworks site"

Metford Road
Metford, NSW

October 2014

General Flora and Fauna

FLORA AND FAUNA ASSESSMENT

Including an account of factors contained in s5A EP&A Act 1979 (the **7 Part Test**)

Client

Health Infrastructure (NSW Government)

For Proposed Development at

the old brickworks site, including
Lot 1, DP 1197061
Lot 1, DP 1195590
Lot 401, DP 755237
Lot 266, DP 755237
Lot 7314, DP 1162607
Metford Road
Metford, NSW

As requested by

Adam Bishop
KMH Environmental
Level 1, 81 Hunter Street, NSW, 2300

October 2014

Reference: GFF 14341

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Principle Consultant - Greg Little BSc

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10.0 APPENDICES

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FLORA AND FAUNA ASSESSMENT

Over

the old brickworks site, including
Lot 1, DP 1197061; Lot 1, DP 1195590; Lot 401, DP 755237;
Lot 266, DP 755237; Lot 7314, DP 1162607
Metford Road
Metford, NSW

October 2014

1.0 INTRODUCTION

1.1 Background

This report describes the findings of a vascular flora and vertebrate fauna survey over the above mentioned site (the **"site"**), on which development is proposed, and assesses the likely impact of the proposed development on threatened species, populations and ecological communities.

The study site is located within the **Maitland City Council** LGA and is zoned

RU2 Rural Landscape

1.2 Proposed Development

The proposed development will -

- Clear a portion of native vegetation from the site
- construction of a Regional Hospital Precinct with associated roadways, parking and landscaping etc
- Retain on the site as much of the existing native forest vegetation as possible

1.3 Scope

For the purposes of this assessment, the survey was limited mainly to the site, however, circumstances on adjacent and nearby land is considered. Fauna and flora on the site was surveyed by observation, trapping, spotlighting, vegetation transects and plots etc.

Methods used for the survey are in general accordance with methods detailed in Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC, 2004) and with the LHCCREMS Flora and Fauna Survey Guidelines, Lower Hunter Central Coast Region 2002 (Murray *et al*, 2002).

The potential affect of the proposed development on threatened species, populations or ecological communities was assessed by the Assessment of Significance under s5A of the *EP&A Act 1979* otherwise known as the 7 Part Test, (**Appendix H**).

Recommendations are made to minimize the impact of the proposed development on the local environment generally but particularly threatened species and endangered ecological communities.

1.4 Literature Search

A literature search generated the following information applicable to the site –

- a list of threatened flora and fauna species from the Bionet wildlife database recorded from within 10km of the study area.
- Flora and Fauna Survey Guidelines from the Lower Hunter and Central Coast Regional Environmental Management Strategy.
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities, Working Draft, (DEC, 2004).
- An EPBC Act Protected Matters Report from the Department of the Environment and Heritage web site.
- Vegetation Survey, Classification and Mapping for the Lower Hunter and Central Coast Region (LHCCREMS, 2003)
- The Maitland Greening, Plan Stage 2, Part B, Maitland City Council (MCC, 2002).
- Documents, reports and books etc may be referred to for information on aspects of the local area and identification, distribution and ecology of flora and fauna encountered in this study (see **7.0 References**).

1.5 Licences and Approvals

This flora and fauna survey was conducted under:

- NSW NPWS Scientific Licence number **SL 100973**
- Animal Research Authority issued by the Director-General of NSW Agriculture.
- Approval of the Animal Care and Ethics Committee of the Director-General of NSW Agriculture.

1.6 Survey Limitations

It is unlikely that all the species of terrestrial flora and vertebrate fauna, including threatened species, using or likely to use the site would be found during the field survey for this assessment.

2.0 SITE DESCRIPTION

2.1 General site description

The "site", found between East Maitland and Thornton (**Fig-1**) in the Maitland City Council LGA, is a triangular shaped area of land of approximately 42 hectares (**Fig-2**). Off the north boundary of the site is the Main Northern Railway, beyond which is East Maitland Cemetery, vacant vegetated land, Raymond Terrace Road and East Maitland Common. Off the south boundary is a powerline easement, beyond which are residential dwellings of the Metford suburb. Off the west boundary is Metford Road, beyond which is Fieldsend Oval and industrial land.

Landform in the north and central portions of this site is highly disturbed having undergone considerable modification by earthworks and extraction for the brickworks that previously operated on the site.

The west portion of the site slopes gently from a broad crest down to a broad shallow drainage depression running northwards across the centre east of the site. The east portion of the site slopes gently down the north.

There is no permanent watercourse through the site. Broad shallow drainage depressions on the site direct surface water northwards to enter wetlands of East Maitland Common, then via Four Mile Creek eventually into the Hunter River, east of Morpeth. Man-made ponds are found on the central drainage depression and as settling ponds in the centre north portion of the site.

Aerial photographs (**Fig-2**) show the site supports remnants of native forest vegetation in the east portion and south-west corner of the site. These remnants of native vegetation have had a history of disturbance including partial clearing, indicated by the lack of large old and hollow bearing trees across the site. Weeds are common across the site. However, in some parts of the site forest vegetation retains much of the original structural and floristic diversity that provides habitat for common and threatened native flora and fauna. Native vegetation in the local region is heavily fragmented by clearing for farmland, roads, residential and industrial purposes. Vegetation remnants on the site are completely isolated from extensive areas of native vegetation to the north and only tenuously connected by broken corridors to areas of native vegetation to the south.

According to soil landscape maps (Matthei, 1995) land across the site is "undulating low hills and rises on Permian sediments", located mostly on Beresfield (be) "Residual Landscape" and partially on Cockle Creek (cc) "Alluvial Landscape".

3.0 METHODS

3.1 Habitat

During this survey, attention was given to habitat found throughout the site. A diversity of habitats which include overstorey, understorey and groundcover vegetation, hollow bearing trees, ponds, lakes, streams, creeks, drainage lines, wetlands, mangroves, mud flats, rock outcrops, cliffs, caves, large rocks, rock piles, dense and open vegetation, flowering and fruiting trees, fallen timber, leaf litter and bark litter etc are all important habitat components for a wide range of flora and fauna.

Note was taken of the broad habitat types and any valuable or sensitive habitat found on the site that may be impacted on by the proposed development.

3.2 Corridors

Investigation of the site as a potential corridor was made by site inspection and review of maps and aerial photographs. Comment is made as to whether the site forms an important corridor or is part of a broad corridor of vegetation or part of a fragmented chain of remnant islands or stepping stones of vegetation and whether the proposed development is likely to compromise the corridor.

3.3 Disturbances

Obvious existing disturbances and possible historical disturbances on the site and disturbances indicated in available literature may be mentioned in this report. Disturbances may include any level of disturbance such as complete or partial clearing, stock grazing, tracks, fencing, roads, weeds, rubbish, bushfire etc.

3.4 Weeds

Weed species, whether native or introduced plants or animals, that are found on the site are recorded and the extent of infestation is noted and will be discussed.

3.5 Stratification Units

Site "stratification units" according to DEC guidelines (DEC, 2004) will be determined according to topography, landforms, vegetation types and habitats across the site.

3.6 Vegetation

Aerial photograph (**Fig-2**) interpretation and ground truthing is performed to map the "broad" vegetation communities found on the study site. Broad vegetation types for the site, local area and region are described according to the vegetation survey, classification and mapping of the LHCCREMS (2003).

Standard vegetation transects and vegetation plots are used across the site to gain information on the vegetation communities present. Details of the vegetation transects and plots are found in Appendices and figures of this report. Transects were located to encompass the greatest variety of landform and vegetation on the site. Plots were located near transects and generally to sample each perceived broad vegetation type.

Threatened plant searches were conducted by "parallel line technique" and by "random meander" (Cropper, 1993) through likely habitat on the site.

All terrestrial and wetland plants (generally not algae or bryophytes) found on the study site were identified and recorded (**Appendix A**) at least to genus level. Plants were collected from the site for identification during transect and plot surveys over the site and opportunistically while moving about the site performing other activities.

3.7 Fauna

Fauna survey design and methods suggested in the LHCCREMS (Murray et al, 2002) and DECC (DEC, 2004) guidelines were employed. Trap, survey locations and results are indicated and presented in Figures, Appendices and Tables of this report:

(a) Elliot "A" small terrestrial mammal traps. 60 traps across Spotted Gum Ironbark Forest (20 east & 20 west), Red Gum Forest (10) and rehabilitation area (10) were set over 4 nights, giving 240 trap nights. These were placed on the ground in appropriate locations on the study site, each about 10 to 20m apart. The traps were baited with a mixture of peanut butter, rolled oats, honey and vanilla essence and were covered in plastic bags if it was likely to rain. Dead leaves, paperbark or grass were placed in each trap as nest material for animals. Traps were checked for captured animals and rebaited if necessary early each morning.

(b) Elliot B arboreal mammal traps. 22 traps were set across the site, Spotted Gum Ironbark Forest (10 east & 6 west), Red Gum Forest (6) were set over minimum 3 nights, giving 66 trap nights. These were positioned on the site in areas likely to support populations of arboreal mammals such as gliders. Traps were also located where they are less visible to people and therefore less vulnerable to disturbance and theft. They were baited with a mixture of peanut butter, rolled oats, honey and vanilla essence and attached to a platform at a height of just over two meters. Dead leaves, paperbark or grass were placed in each trap as nesting material and traps were covered in plastic bags if rain was likely. A 50% honey and water mixture was sprayed onto the tree trunk around and above each trap. They were checked for captured animals early every morning and re baited if necessary.

(c) Cage traps (medium, terrestrial) and Elliot B terrestrial traps. 8 cage traps and 5 Elliot B traps were set on the ground over a minimum of 3 nights across the site, Spotted Gum Ironbark Forest (4 east & 3 west), Red Gum Forest (3) and rehabilitation area (3) were set over minimum of 3 nights, giving 39 trap nights. These were baited with a mixture of peanut butter, rolled oats, honey and vanilla essence plus a piece of apple. One cage trap at each location was also baited with chicken meat. Traps were covered with a piece of carpet for sun and rain protection and were checked for captured animals and rebaited if necessary early every morning.

(d) Hair trap tubes. 24 large (90mm) and 24 small (40mm) hair trap tubes were set in sets of six pairs across the site. These are set on the ground at the base of trees (90mm) and up the trunk of the same tree at about 2m (40mm), at each of four locations on the site.

(e) Harp traps, to capture insectivorous bats, were each set over two nights at four separate locations across the site.

(f) String lining for insectivorous bats was not performed at this site as no suitable pond location was available.

(g) Bat call detection devices (Anabats). 2 units were used on each of three separate nights for a minimum of four (4) hours each per night, depending on the weather. Anabats were used at suitable fixed locations on the site and while hand held and walking about the site.

(h) Cameras, collecting daylight and infrared night images. Four cameras activated by movement were installed at several locations about the site and left in the field for two to four nights. A chicken meat bait and the rolled oats bait mixture were place at two to three meters from each camera.

(i) Nocturnal spotlight searches. Performed for more than 3 hours, at least 1 hour on each of three nights, over the study site, using a 50 watt hand held spotlight powered by a portable 12 volt rechargeable battery. A typical spotlighting transect followed tracks and gaps in vegetation throughout the site. Additional spotlighting occurred while otherwise moving about the site performing other activities during the night.

(j) Owl-call playback. Was performed on two (2) nights at two separate locations near the centre of the site. Calls of the Powerful Owl, Masked Owl, Sooty Owl and Barking Owl were played out

early in the evening. Several minutes of quiet were allowed prior to the calls and again after the calls before searching nearby trees, with a spotlight, for owls that have been attracted by the calls.

(k) Call playback of Bush Stone-curlew calls was performed at the same time and location of owl call playback.

(l) Frog-call playback for the threatened frogs was performed on two separate nights over potentially suitable habitat for locally threatened Green and Golden Bell Frogs.

(m) Listening. From time to time spotlighting or other activities are interrupted by periods of still and quiet listening for animal calls and the sounds of animal movement in vegetation and on the ground.

(n) Diurnal (daytime) searches for reptiles were performed by using binoculars to search logs and track edges etc, raking leaf and bark litter and searching under logs, bark and rubbish etc. Any species found, including those observed incidentally, were recorded.

(o) Nocturnal and diurnal searching for frogs was performed by investigating potential habitat at the edge of ponds on the site and by listening for calls. Any species observed or heard incidentally was recorded. Any unfamiliar frog calls would be tape recorded and compared against commercially available recordings.

(p) Eight (8) bird sample plots, 20 minutes each, were performed across the study site, often while conducting other activities, during periods when bird activity was high, usually in the morning or late afternoon. Incidental bird records were gained by observation and listening, both nocturnally and diurnally, while performing other activities about the study site. Any unfamiliar bird calls would be tape recorded and compared against commercially available recordings.

(q) Signs of the presence of species by indications such as scats, tracks, scratches, diggings, fallen fruit and flower buds, chewed casuarina cones, burrows, nests, bones, skins etc were noted. Where determined the apparent species was recorded but noted that this may be unconfirmed unless the identification is positive.

The following threatened fauna survey methods are DEC (2004) survey guidelines.

PLEASE NOTE - the DECC guidelines are for effort per 50 to 100 hectares of Stratification Unit, this site is approximately 42 hectares in area.

Frogs Table 5.3, DEC

Method	Minimum Effort	Survey Period	This survey
Day habitat search	One hour per SU	According to seasonal activity of target sp.	Yes
Night habitat search	30 minutes, two separate occasions, per SU	According to seasonal activity of target sp.	Yes
Nocturnal call playback	One call playback, for each species, on two separate nights	According to seasonal activity of target sp.	Yes
Night watercourse search	Two hours per 200m of water body edge	According to seasonal activity of target sp.	Yes

SU = Stratification Unit

Reptiles Table 5.4, DEC

Method	Effort / SU up to 100ha	Survey Period	This survey
Habitat search	30 min search on two separate days targeting specific habitat	November to March, preferred	Yes
Pitfall traps	24 trap nights, 6 traps x 4 consecutive nights	November to March, preferred	No, soil too hard and no threatened reptiles likely at this site

Spotlighting	30 minute search two separate occasions	November to March, preferred	Yes

SU = Stratification Unit

Birds (diurnal) Table 5.5, DEC

Method	Minimum Effort	Survey Period	This survey
Area search	All birds recorded in 1ha area over 20 minutes	All year	Yes
Wetland census	1 hour census, dawn or dusk, each wetland	All year	Yes
Water source census	20 minute census, dawn or dusk, each water source	All year	Yes

SU = Stratification Unit

Birds (nocturnal) Table 5.7, DEC

Method	Minimum Effort	Survey Period	This survey
Call playback (night)	• Sites separated by 800 – 1000m • 5 different night visits per site for Powerful Owl, Barking Owl & Grass Owl • 6 different night visits per site for Sooty Owl • 8 different night visits per site for Masked Owl	All year	• Powerful Owl • Masked Owls • Barking Owl • Sooty Owl • Bush Stone-curlew • Two nights
Day habitat search	• Search for pellets and hollows • Flush Bush Stone-curlew by walking through potential habitat	All year	Yes
Stag watching	Watch potential roost or breeding hollows for 30 minutes prior to dark and 60 minutes after dark	All year	No
Spotlighting	Search for Plains Wanderer & Bush Stone-curlew by foot or vehicle	All year	Yes

SU = Stratification Unit

Mammals (non flying) Table 5.8, DEC

Method	Effort / SU up to 50ha plus additional effort for every 100ha	Animal sampled	This survey
Small Elliot Traps (Ell A)	120 trap nights over 3-4 consecutive nights	Small mammals	Yes
Large Elliot Traps (Ell B)	100 trap nights over 3-4 consecutive nights	Medium to large mammals	As per cage traps
Arboreal Elliot Traps (Ell B)	24 trap nights over 3-4 consecutive nights	Arboreal mammals	Yes
Wire Cage Traps	24 trap nights over 3-4 consecutive nights	Medium to large mammals	Yes
Pitfall Traps & drift fence	24 trap nights over 3-4 consecutive nights	Small mammals	No, soil too hard, cameras used instead
Hair tubes	10 large and 10 small tubes in pairs, over minimum 4 nights	Small & medium mammals	Yes
Arboreal hair tubes	3 tubes in each of 10 habitat trees, up to 100 ha, minimum 4 nights	Arboreal mammals	Yes
Spotlighting on foot	1 hr x 1km / 200ha of SU, 2 nights	Arboreal & terrestrial mammals	Yes
Spotlighting from vehicle	1km of track @ 5km/hr / 200ha of SU, 2 nights	Arboreal & terrestrial mammals	No
Sand Plots	6 soil plots for 4 nights	Medium to large mammals	Cameras used instead
Call playback	2 sites (separate nights) / SU up to 200ha, plus 1 site / 100ha above	Gliders & koalas	No

	200ha		
Stag watching	Watch potential roost or breeding hollows, 30 minutes prior to dark & 60 minutes after dark	Gliders & possums	No
Search for scats and signs	30 minutes search	All mammals	Yes
Track search	1km of track, especially soft substrate	Medium to large mammals	Yes
Collection of predator scats	Opportunistic collection of predator scats for ID	All mammals	Yes scats identified on site

SU = Stratification Unit

Bats Table 5.10, DEC

Methods	Effort / 100ha SU, targeting preferred habitat	Survey Period	This survey
Harp Trapping	4 trap nights over 2 nights	October to March, preferred	Yes
Ultrasonic call recording	2 Anabats x 2 nights, recording entire night (or minimum 4 hrs)	October to March, preferred	Yes
Mist netting	For targeted survey: one net set min 2 hrs each of 2 nights	October to March, preferred	No
Trip Line	For targeted survey: min 2 hrs each of two nights	October to March, preferred	No
Spotlighting & transect walk	For targeted survey near likely food sources: min 2 hrs each of 2 nights	All year	Yes
Day habitat walk	Search for bat excreta at or near potential habitats	All year	Yes

SU = Stratification Unit

3.8 Threatened species & Assessment of Significance (7 Part Test)

A list of threatened species from within a 10km radius of the study site (**Appendix G**) was obtained from the Bionet - Atlas of NSW Wildlife data. These species are found in Schedules of the Threatened Species Conservation Act 1995.

Search criteria : Public Report of all Valid Records of Threatened (listed on TSC Act 1995) Entities in selected area [North: -32.64 West: 151.48 East: 151.73 South: -32.89] returned a total of 5,604 records of 70 species. Report generated on 22/09/2014 11:28 AM

The factors contained in s5A of the Environmental Planning and Assessment Act 1979 (the **7 Part Test**) will be taken into account and applied to the threatened species as an Assessment of Significance (**Appendix H**).

Where no habitat is found on the study site or adjacent areas for a particular threatened species that species is indicated as such (**Appendix G**) and not addressed in the seven part test as that species is unlikely to utilise the site or be affected by the proposed development.

Some threatened species not in the Bionet database for the area but likely to be found in the area and likely to use habitat in the study area, may also be considered in this assessment.

3.9 Endangered Populations, Ecological Communities & Critical Habitat

Lists of "endangered populations", "endangered ecological communities" and "critical habitat" are found in the Threatened Species Conservation Act 1995 as follows:

- Endangered Populations - Schedule 1 (Part 2)
- Endangered Ecological Communities - Schedule 1 (Part 3)
- Critical Habitat - Part 3 of the Act

The above lists were reviewed and an assessment made of flora and fauna populations, ecological communities and habitat found on the site or adjacent areas to determine if the proposed development would have an impact on any listed endangered population, endangered ecological community or critical habitat.

3.10 Locally and Regionally Significant Species and Communities

Due to their natural rarity or the historic extent of clearing there are a number of flora and fauna species and vegetation communities that are regionally or locally significant and may require some conservation consideration. Any regionally or locally significant species or communities found on the site or adjacent areas will be recorded and discussed. Regionally significant species and communities are those identified and listed by local government areas or councils.

The LHCCREMS, Flora and Fauna Survey Guidelines (Murray *et al*, 2002), lists regionally and locally significant species and communities for the region. The appropriate lists were reviewed for this report.

3.11 EPBC Act 1999 - Matters of National Environmental Significance

Under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) an action will require approval from the Australian Government Environment Minister if the action has, will have or is likely to have, a significant impact on a matter of National Environmental Significance.

This component of the report will be guided by the Matters of National Environmental Significance – "Significant Impact Guidelines", 1.1 Environment Protection and Biodiversity Conservation Act 1999.

3.12 Koala Habitat

A Koala habitat assessment for the site is made as according to State Environmental Planning Policy No. 44 (NSW GIS, 2000), the site is over 1 hectare in area and is located within a Local Government Area (LGA) known to support populations of koalas (Schedule 1 of SEPP 44).

4.0 RESULTS

4.1 Habitat

Located on undulating to low hills and rises on coastal plain between the coast and ranges with low fertility soils and relatively humid near coastal location provides the environment for native vegetation found on the site and local region. Across the site is a partial cover of native dry sclerophyll forest vegetation some of which is in relatively good condition.

Native forest vegetation on the site provides forage, refuge and breeding habitat for native fauna. Vegetation itself provides leaves, flowers, nectar, pollen, fruit and seeds etc as forage for a wide range of vertebrate and invertebrate fauna and these are then prey for other fauna. Refuge and breeding habitat on the site includes tree canopies, understorey and thick groundcover vegetation, leaf litter, loose bark, fallen logs and tree hollows.

Twelve live and dead hollow bearing trees were recorded on this site (**Fig-3**), these are found in the south-east forest portion of the site. Information on these hollow bearing trees is found in **Appendix-M**. Trees with obvious hollows are not found elsewhere on the site. Live and dead hollow bearing trees with hollows, cracks and fissures etc are a "valuable" fauna resource on the site. Hollows on the site could potentially be used as refuge, nest, den, roost and breeding habitat by hollow dependent fauna such as owls, owlet nightjars, cockatoos, parrots, possums, gliders, lizards, snakes, frogs and insectivorous bats.

Rock outcrop, cliffs and exposed bedrock is found on the site, however, it appears that most of this is from disturbances during previous use of the site. There are no caves associated with the rock outcrop and none found anywhere else on the site.

Two ephemeral drainage lines are found running across the site. A drainage line runs northwards across the centre of the site another runs north-west across the south-west corner of the site (**Fig-3**). The drainage lines are found in the base of broad shallow natural depressions of the gently undulating landscape of which the site is a part. These drainage lines direct intermittent surface water through the depressions. For much of their length the drainage lines are very shallow and do not have defined beds and banks. In some parts the drainage line and associated depression have been disturbed by earthworks or support ponds caused by construction of tracks or the rail line off the north of the site (**Fig-3**). While Four Mile Creek, several hundred meters east of the site, is listed as a "Prescribed Stream" (Gordon, 1977) neither of the drainage lines across the site are listed prescribed streams. The drainage lines are not marked on the 1:25,000 topographic map (Beresfield 9232-3N) covering the site. Furthermore, correspondence with a Water Regulation Officer of the Department of Primary Industries finds that "the site in question does not appear to contain any watercourses, or be located within 40m of any watercourses, and is therefore not considered to be waterfront land". Therefore, the drainage lines across the site are not identified as streams. However, vegetation over and immediately adjacent to the drainage lines does support riparian vegetation as riparian land is described as including "gullies and dips which sometimes run with surface water" (Lovett & Price, 1999).

For most of the length of the drainage line across the south-west corner of the site (**Fig-3**) the "riparian vegetation" is little different to the forest vegetation through which it flows. The drainage line flowing north across the centre of the site does include two shallow man-made ponds. One is formed by earthworks for a track across the drainage line. If the track is removed the pond will likely dry up and disappear. The second pond is formed at the north

end of the drainage line where earthwork for the rail line appears to have caused a pond. Maybe a drain under the rail line is blocked by debri causing the ponding effect. These shallow ponds support wetland vegetation such as Cumbungi and Reeds. The central pond has an open water surface that at the time of this survey was covered with Azolla.

4.2 Corridors

Aerial photographs show that native vegetation in the local region is heavily fragmented and that native vegetation on the site is not part of a corridor of vegetation. Broken corridors through urban areas south and west of the site may provide a tenuous connection between native forest vegetation on the site and larger areas of native forest vegetation south of the site.

Much of the existing native forest vegetation remnants on the east and west portions of the site will be retained. A corridor of vegetation will be maintained along the south boundary and parts of the north boundary of the site to connect these remnants (**Fig-6**).

Additional plantings of local native trees, shrubs and groundcovers in existing gaps along the south boundary would enhance the usefulness of the corridor. Roads cutting through the corridor should be as narrow as possible and have trees and shrubs etc retained or planted as close as possible to the edge of the road to minimize the gap in the corridor.

4.3 Disturbances

The central and north portions of the site have been completely cleared and highly disturbed (**Fig-3**). In most of this area the original soil and the underlying bedrock has been removed. A central portion off the site has been "rehabilitated" by replanting with a mixture of local and non-local native plant species. The rehabilitated area is now heavily weed infested and of little use to native fauna.

Native forest vegetation on the east and west portions of the site is in relatively good condition, however, this vegetation has been disturbed to some level by partial clearing, earth works, tracks, rubbish, fencing, bushfire and weeds, plus the site may have been grazed in the past. Partial clearing is evidenced by the lack of large old hollow bearing trees across the site.

Ponds on the shallow drainage line through the centre-east of the site (**Fig-3**) are apparently a result of disturbances by a vehicular track and the embankment for the rail line off the north boundary.

4.4 Weeds

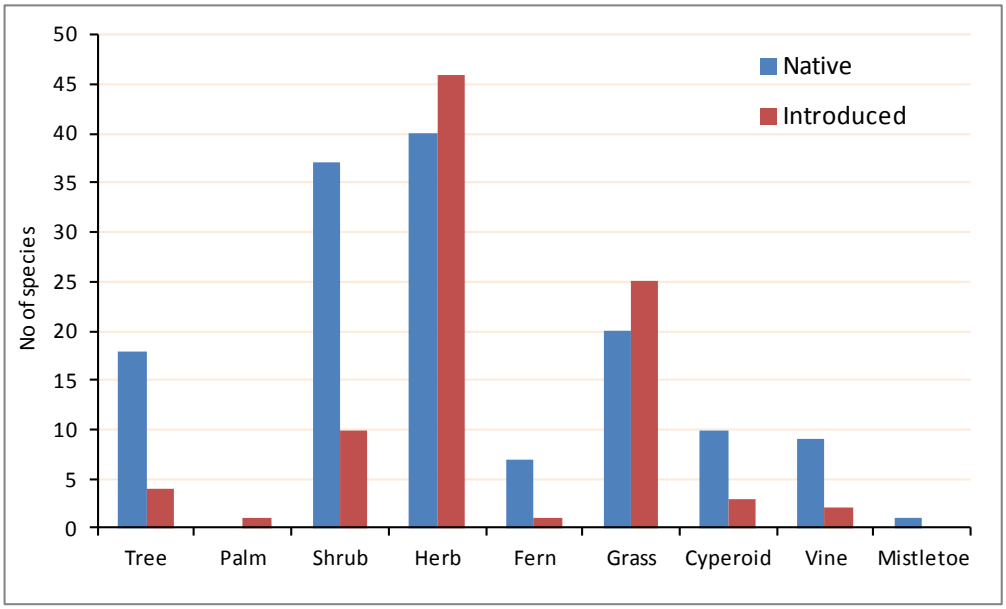
Most introduced exotic weeds on the site are herbs and grasses (**Graph-1**). Many weeds were recorded on the road reserve on the west edge of the site. High levels of weeds are associated with disturbed areas such as the rehabilitation area in the centre of the site as can be observed on review of **Graph-2** and **Fig-5**. Transects and plots through less disturbed forest vegetation on the site recorded relatively low levels of weeds (see TB to TE and P2 to P5). Impenetrable thickets of Lantana are found in some parts of the centre of the site. A heavy infestation of both Small-leaved Privet and Lantana are found over parts of the shallow drainage line in the south-west corner of the site.

4.5 Stratification Units

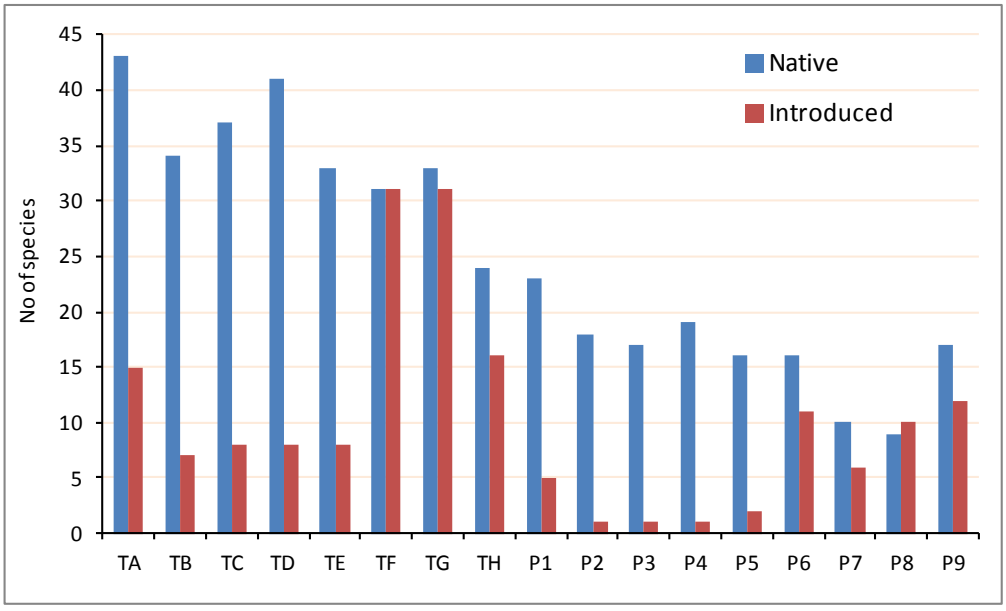
This site is divided into three (3) broad Stratification Units, these being the forest vegetation, the rehabilitation area and the completely cleared (**Fig-3**). The forest includes Spotted Gum

ironbark Forest and Red Gum Forest. The rehabilitation area includes regrowth and areas of replanting with native plants in an attempt at rehabilitation over heavily cleared and disturbed land. The completely cleared area is highly disturbed and supports no natural vegetation.

Graph – 1 Showing proportion of native and introduced plant forms in vegetation on the site.



Graph – 2 Showing proportions of native and introduced plants recorded in each transect (T) and plot (P).



4.6 Vegetation

234 plant species were recorded on the site during this survey, including 142 native and 92 introduced weed species. All plants recorded on the site are listed in **Appendix A**. A simple breakdown of the broad plant forms found across the site is presented in **Graph-1**. Relative numbers of native and introduced weed plants in survey plots and transects across the site are presented in **Graph-2**.

According to LHCCREMS (2003) vegetation mapping for the area, vegetation over the site is described as "Alluvial Tall Moist Forest" (MU5) and "Lower Hunter Spotted Gum Ironbark Forest" (MU17). However, investigation finds that the LHCCREMS (2003) mapping for this site is inaccurate and that the portion of the site mapped as Alluvial Tall Moist Forest should be mapped as "Hunter Lowlands Redgum Forest" (MU19). Lower Hunter Spotted Gum Ironbark Forest and Hunter Lowlands Redgum Forest are identified in **Fig-3** as "Spotted Gum Ironbark Forest" and "Red Gum Forest" respectively.

Forest communities on the site (**Fig-3**) support an overstorey of mostly small to medium sized, young and mature trees, up to about 20m. Spotted Gum (*Corymbia maculata*) and Broad-leaved Ironbark (*Eucalyptus fibrosa*) trees dominate the Spotted Gum Ironbark Forest community. Forest Red Gum (*E. tereticornis*) and Rough-barked Apple (*Angophora floribunda*) trees dominate the Red Gum Forest community. Within the understorey of both forest communities Blackthorn (*Bursaria spinosa*) is dominant in most forest parts except the east corner of the site. Other common shrubs in these communities include *Acacia elongata*, Falcate Wattle, Gorse Bitter Pea, Sydney Golden Wattle and Silver-stemmed Wattle. Groundcovers in most forest areas are dominated by Kangaroo Grass, Three-awned Spear Grass and *Entolasia stricta* plus a range of native herbs, ferns and low shrubs.

The rehabilitation and regrowth areas support a range of local and non-local native trees, shrubs, herbs and grasses over previously cleared land, areas of mixed soils, shallow man-made ponds and spoil piles. Trees such as Narrow-leaved Apple and Narrow-leaved Ironbark which may occur in the local region but not originally on the site have obviously been planted on the west edges of the completely disturbed areas and in the rehabilitation areas of the site. Trees and shrubs such as Forest Red Gum, Swamp She-oak, Ball Honeymyrtle and Snow-in-summer are also planted in this area. Much of the groundcover in the rehabilitation area is dominated by exotic weed grasses such as Rhodes Grass, Guinea Grass and Vasey Grass plus a variety of exotic herbs.

All ponds on the site appear to be either intentionally man-made, such as the settling ponds in the centre of the site, or caused by actions that impede the flow of drainage lines across the site. A number of small shallow ponds in the south-west corner of the site appear to be the result of past quarrying activity. These support a few water plants such as Tall Spike-rush. Two ponds on the centre drainage line support dense covers of Cumbungi plus a variety of over water plants such as native Water Ribbons and Knotweed. Open water areas in these ponds are covered in Azolla, a native water fern. The several settling ponds are either dry or include various densities of Cumbungi, Common Reed, Jointed Twig-rush, Tall Spike-rush, *Schoenoplectus validus*, *Bolboschoenus caldwellii* and Wooly Frogmouth plus the introduced Spiny Rush.

4.7 Fauna

116 species of native and introduced fauna were recorded on the site during this survey (**Chart-A**) including 106 native and 10 introduced species. All fauna recorded on or near the study site during this survey are listed in **Appendix B**.

4.7.1 Mammals

24 mammal species were recorded on the site during this survey of which 19 are native and 5 are introduced species (**Appendix B**). Larger native terrestrial mammals recorded on the site included only the Grey Kangaroo. Smaller terrestrial mammals recorded on the site included

Brown Antechinus and Swamp Rat (by hair tube only). Aboreal mammals recorded on the site included only Squirrel Glider and Feather-tailed Glider, however, other arboreal mammals such as common Sugar Gliders, Ring-tailed Possum and Brush-tail Possums could be recorded on the site. Flying mammals recorded on the site included Grey-headed Flying-fox plus thirteen (13) species of insectivorous bats. Grey-headed Flying-foxes were recorded flying over the site and heard in trees south-east of the site. These flying-foxes will feed in blossoms of Spotted Gum on the site when these trees are in flower, however, there was no roosting "camp" of these bats recorded on the site. Most of the insectivorous bats recorded on the site roost and breed in tree hollows and may be using hollows in trees on the site. Insectivorous bats such as Little Bentwing Bat, Large Bentwing Bat and Large-footed Myotis roost naturally in caves but also mines, culverts and under bridges etc. While foraging on the site these species will be roosting and breeding off site in the local region.

Introduced mammals recorded on the site included Black Rat, Cat, Dog, Fox, Brown Hare and Rabbit.

Chart – A Showing number of fauna species in each faunal group recorded on the site.

	Natives	**Introduced**	**Total**
Mammals	19	6	25
Birds	73	4	77
Reptiles	6	0	6
Frogs	8	0	8
Fish	0	1	1
Total	106	11	**117**

4.7.2 Birds

Most of the seventy three (73) native birds recorded on or about the site are typical bushland and semi rural birds of the local region. Four (4) introduced bird species were recorded on the site. More bird species are likely to be recorded during warmer months, especially when migratory species are present.

No owls were recorded on the site during this survey although owls are likely to forage for prey species on the site. There are a small number of larger old hollow bearing trees on the site that may provide suitable breeding or refuge habitat for some owl species. The only nocturnal bird recorded on the site was Tawny Frogmouth.

Of interest were the Yellow-tailed Black Cockatoos, King Parrot and Rose Robin. Yellow-tailed Black Cockatoos were recorded flying over the site. The large Yellow-tailed Black Cockatoos are unlikely to breed in larger hollow bearing trees on the site, however, this Cockatoo may occasionally forage in vegetation on the site. The Rose Robin is a well known altitudinal migrant, and was probably moving through the site on its way to the cooler ranges for summer.

Tree hollows on the site (**Fig-3**) may be important breeding habitat for native hollow nesting birds such as parrots, lorikeets, cockatoos, ducks, treecreepers, pardalotes, kingfishers and owls etc. An unidentified duck, possibly a Wood Duck, was observed leaving one of the tree hollows.

Several common water bird species were observed using ponds on the site including Wood Duck, Pacific Black Duck, Chestnut Teal, Little Pied Cormorant, White-faced Heron, White-necked Heron, Great Egret, White Ibis and Royal Spoonbill.

4.7.3 Reptiles

Six (6) common reptile species were recorded on the site during this survey. These included Robust Skink, Garden Skink, Eastern Water Skink, Blue-tongued Lizard, *Carlia tetradactyla* and Bearded Dragon. Several other common reptiles are likely to be found on the site by day and night searches during warm weather.

4.7.4 Frogs

Eight (8) common frog species were recorded on the site during this survey. These are all common frogs that were heard or observed in several different parts of the site, not just the ponds. At least a few other species of common frogs are likely to be found on the site during warm, wet weather night searches.

Targeted survey for Gold and Green Bell Frog (*Litoria aurea*) was conducted about ponds on the site during this survey. Further targeted survey for this species will be conducted during the rest of this year.

4.7.5 Fish

Mosquito Fish (*Gambusia holbrooki*) were observed in most open pools of water in the drainage lines and the old settling ponds on the site. No native freshwater fish or eels were observed in ponds on the site.

4.8 Threatened Species & the Assessment of Significance (7 Part Test)

Seventy (70) threatened flora and fauna species are recorded on the Bionet Wildlife database within 10km of this site. Of these there is potential habitat on the site for about 44 species, including 12 threatened flora and 32 threatened fauna. Seven (7) threatened fauna species, as listed below, were recorded on the site during this survey. No threatened flora species were recorded on the site during this survey.

The following threatened fauna species were recorded on the study site:

• *Glossopsitta pusilla*	Little Lorikeet	V
• *Petaurus norfolcensis*	Squirrel Glider	V
• *Pteropus poliocephalus*	Grey-headed Flying-fox	V
• *Miniopterus australis*	Little Bentwing Bat	V
• *Miniopterus schreibersii oceanensis*	Large Bentwing Bat	V
• *Myotis macropus*	Large-footed Myotis	V

The above threatened fauna are addressed in the Assessment of Significance or 7 Part Test (**App-H**) of this report.

In summary, the above threatened species were recorded on the site and the site does support forage habitat for each of these species. Hollow bearing trees on the site (**Fig-3**) may also

provide refuge, breeding, nest and den habitat for the Little Lorikeet and the Squirrel Glider. The Grey-headed Flying-fox and the three insectivorous bat species are likely roosting off site and elsewhere in the local region. It was considered that much of the existing native forest vegetation and most of the hollow bearing trees will be conserved on the site as habitat for the above and other threatened species. Therefore, it was found that the life cycle of these threatened fauna species is unlikely to be disrupted by the proposed development such that a viable local population of the threatened species would be placed at risk of extinction.

Green and Golden Bell Frogs are best surveyed during warm wet nights. Some threatened plant species are easier to detect during certain months of the year when they are in flower. Further survey shall be conducted in suitable habitat across the site for these threatened species, on three separate occasions during the following indicated months. Results of these surveys will be provided as an addendum to this report.

Proposed survey months for threatened plants and Green and Gold Bell Frog.

Scientific Name	**Common Name**	J	F	M	A	M	J	J	A	S	O	N	D
Cynanchum elegans	White-flowered Wax Plant									s	s	s	
Rutidosis heterogama	Heath Wrinklewort										s	s	
Tetratheca juncea	Black-eyed Susan									s	s	s	
Acacia bynoeana	Bynoe's Wattle									s	s	s	
Maundia triglochinoides												s	s
Callistemon linearifolius	Netted Bottle Brush									s	s	s	
Eucalyptus parramattensis	Parramatta Red Gum									s	s	s	
Syzygium paniculatum	Magenta Lilly Pilly											s	s
Persicaria elatior	Tall Knotweed									s	s	s	
Grevillea parviflora	Small-flower Grevillea									s	s	s	
Zannichellia palustris										s	s	s	
Litoria aurea	Green and Golden Bell Frog										s	s	s

s = survey months

4.9 Endangered Populations, Ecological Communities & Critical Habitat

These factors are dealt with fully in **Appendix H** of this report.

4.9.1 Endangered Populations

This site does not support an Endangered Population. No threatened flora or fauna species found within 10km of the study site are part of an "endangered population" cited in Schedule 1, Part 2 Endangered Populations of the TSC Act 1995.

4.9.2 Endangered Ecological Communities

This site does support two "Endangered Ecological Communities" (EEC's) identified under Part 3 of Schedule 1 of the TSC Act 1995.

Lower Hunter Spotted Gum Ironbark Forest and Hunter Lowlands Redgum Forest, as recognized under LHCCREMS vegetation mapping (2003) are found across the site. Their distribution across the site is indicated in **Fig-3** as "Spotted Gum Ironbark Forest" and "Red Gum Forest" respectively. These vegetation communities are recognized as Endangered Ecological Communities and are addressed in **Appendix–H** of this report.

The two EEC's identified on the site are

- **Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion**
- **Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions**

Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion is found on the south-east and south-west corner portions and along much of the south edge of the site (**Fig-3**).

Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions is found either side of a shallow drainage depression in the centre north portion of the site (**Fig-3**).

The proposed development is unlikely to **have an adverse effect on the extent** of an ecological community such that its local occurrence is likely to be placed at risk of extinction.

The proposed development is unlikely to **substantially and adversely modify the composition** of an ecological community such that its local occurrence is likely to be placed at risk of extinction.

4.9.3 Critical Habitat

This site does not support Critical Habitat, as listed under Schedule 1A, Part 2 of the TSC Act 1995.

4.10 Regionally and locally significant species and communities

These are dealt with fully in **Appendix-E** of this report.

4.10.1 Matters of Regional Significance

Species of regional significance recorded on the site were –

Triglochin microtuberosum	Water Ribbons
Calyptohynchus funereus	Yellow-tailed Black Cockatoo
Macropus giganteus	Eastern Grey Kangaroo
Vespadelus pumillus	Eastern Forest Bat
Pogona barbata	Eastern Bearded Dragon
Carlia tetradactyla	Southern Rainbow Skink
Limnodynastes tasmaniensis	Spotted Marsh Frog

The proposed development is unlikely to have a significant impact on the above regionally significant species.

A heavily cleared vegetation community, Hunter Lowland Redgum Forest, is found on the site. This vegetation community is addressed elsewhere in this report. Much of this vegetation community will be retained on the site.

Habitat corridors will be maintained between forest remnants on the west and east portions of the site.

4.10.2 Matters of Local Significance

Squirrel Gliders (*Petaurus norfolkensis*) were recorded during this survey in forest vegetation on the west portion of the site. Much of the existing forest vegetation on the site plus hollow

bearing trees will be retained on the site as forage, refuge and breeding habitat for Squirrel Gliders.

A number of hollow bearing "habitat" trees are found on the site, some of these trees are likely to be used by Squirrel Gliders. Most of the hollow bearing tree retained on the site by the proposed development.

The proposed development is unlikely to have a significant impact on matters of local significance (**Appendix E**).

4.11 EPBC Act 1999 - Matters of National Environmental Significance

The proposed development is assessed fully in **Appendix-F** of this report according to the Matters of National Environmental Significance – "Significant Impact Guidelines", 1.1 Environment Protection and Biodiversity Conservation Act 1999.

The proposed development is unlikely to significantly impact Matters of National Environmental Significance under the EPBC Act that may potentially be found on the site.

4.12 Koala Habitat

Steps are followed in State Environmental Planning Policy No.44 – Koala Habitat Protection (SEPP No44) to determine if the site is "potential" or "core" Koala habitat (**Appendix-L**).

Two Koala feed tree species are found on the site, including Forest Red Gum and Grey Gum. The number of individual trees of these species combined probably exceeds 15% of the number of native trees on the site. Therefore, the site is potential Koala habitat.

The land, the site, is not core Koala habitat, therefore, no further provisions of the policy apply.

5.0 DISCUSSION

Proposed development of this approximately 42ha site at the old brickworks site, Metford Road, Metford, will -

- Modify and prepare most of the existing disturbed land on the site for a "Regional Hospital" and larger Precinct
- Clear a limited area of existing native vegetation on the site for the "Regional Hospital Precinct" and associated Asset Protection Zone
- Retain on the site as much as possible of the existing native vegetation

Much of this site is already highly disturbed and cleared (**Fig-3**) plus parts of the existing native forest vegetation cover on the site is also disturbed by previous use of the site. The proposed development would modify most of the already highly disturbed portions of the site and may clear or partially clear some existing forest vegetation on the site. However, much of the existing forest vegetation on the site can be conserved, as habitat for threatened and common species, and remain connected by corridors of existing or planted native vegetation (**Fig-6**). Some or all of the man-made settling ponds and ponds on the drainage line will likely be retained as part of landscaping for the site.

Two native vegetation communities and a derived community are found across this site. Native forest vegetation is identified, according to LHCCREMS vegetation mapping, as "Lower Hunter Spotted Gum Ironbark Forest" over the east and west corner portions of the site and "Hunter Lowlands Redgum Forest" over the centre north portion of the site (**Fig-3**). The former is identified as Spotted Gum Ironbark Forest in **Fig-3**. The latter vegetation community is labelled as Red Gum Forest in **Fig-3**. The derived vegetation appears to be formed by "rehabilitation" replanting with local native plant species over mixed soils and cleared land plus self introductions from the adjacent native vegetation and a high infestation of exotic weeds.

Vegetation across the site supports approximately 234 plant species, including 142 native trees, shrubs, herbs, ferns, vines and grasses etc plus 92 exotic introduced species of mostly grasses and herbs. While disturbed by partial clearance, earthworks, weeds, fencing, rubbish and tracks etc the native forest vegetation across the site is in relatively good condition. Most trees on the site are young mature trees indicative of past clearing. Dominant trees of the Spotted Gum Ironbark Forest on the east and west corner portions of the site (**Fig-3**) include Spotted Gum and Broad-leaved Ironbark. Dominant trees in the Red Gum Forest of the centre north portion of the site include Forest Red Gum and Rough-barked Apple. The rehabilitation area supports clusters of mainly Forest Red Gum and Swamp She-oak trees over low shrubs and mostly exotic herbs and grasses.

Over one third of plants (39%) recorded on the site are exotic introduced weed species (**Appendix A** and **Graphs 1 & 2**). Most are grass and herbaceous weeds typically associated with disturbed land and are found mostly in the cleared and rehabilitated areas of the site (**Fig-3**). Introduced weeds are in lower numbers through less disturbed areas of forest vegetation and at relatively high levels in more disturbed parts of the site. Weeds such as Lantana and Small-leaved Privet form dense thickets in some areas. Several (9) noxious weed species are found across the site. Five species of noxious weeds were recorded on Transect A, reflecting disturbance in that area.

Several (12) hollow bearing trees with hollows in stems and branches plus cracks, fissures, crevices and loose bark are found in Spotted Gum Ironbark Forest in the east portion of the site (**Fig-3**). Live or dead hollow bearing trees are a valuable habitat resource for hollow dependent fauna, such as threatened Owls, Squirrel Gliders and insectivorous bats. Most of the hollow bearing trees will likely be retained even within Asset Protection Zones. Hollow bearing trees that are removed should be replaced with nest boxes.

Two ephemeral drainage lines are found running across the site. There is no permanent watercourse through the site. A drainage line runs northwards across the centre of the site another runs north-west across the south-west corner of the site (**Fig-3**). The drainage lines are found in the base of broad shallow natural depressions of the gently undulating landscape of which the site is a part. These drainage lines direct intermittent surface water through the depressions. For much of their length the drainage lines are very shallow and do not have defined beds and banks. In some parts the drainage line and associated depression have been disturbed by earthworks or support ponds caused by construction of tracks or the rail line off the north of the site (**Fig-3**). Neither of the drainage lines across the site are listed as Prescribed Streams (Gordon, 1977) and are not marked on topographic maps. According to the DPI the site does not contain a watercourse and is therefore not considered waterfront land. However, vegetation over and immediately adjacent to the drainage lines would be considered as riparian vegetation. Investigation found a distinct riparian vegetation type is not found over the drainage lines. Some wetland type plant species such as sedges, rushes and knotweeds plus herbaceous weeds such as Crofton Weed are growing in the damp soil of the drainage line. However, vegetation growing across the drainage line is the same as that growing in the adjacent forest community except at locations where infested with Lantana and Small-leaved Privet such as in the west corner of the site. The ponds formed on the drainage lines are likely to provided habitat for some common local frogs but are unlikely to be important habitat for threatened fauna.

A number of shallow man-made ponds are found on heavily disturbed land in the centre north of the site. These may have been constructed as settling ponds for sediment trapping and water clarification before discharging surface water from the site into the drainage line that flows northwards and eventually into the Hunter River via Four Mile Creek and East Maitland Common. Survey for Green and Golden Bell Frog (*Litoria aurea*) will confirm the presence or absence of this threatened frog in the ponds, including ponds on the drainage line, to determine if these ponds are an important wetland habitat that must be retained.

Aerial photographs show that native vegetation in the local region is heavily fragmented and that native vegetation on the site is not part of a distinct corridor of vegetation. A corridor of vegetation will be maintained along the south boundary and parts of the north boundary of the site to connect existing native forest vegetation remnants on the east and west portions of the site. Additional plantings of local native trees, shrubs and groundcovers in existing gaps along the south boundary would enhance the usefulness of the corridor. If roads are required that cut through the corridor then the roads should be as narrow as possible and have trees and shrubs etc retained or planted as close as possible to the edge of the road to minimize the gap in the corridor. Two separate narrow roads with an island of treed vegetation between would also be suitable. Wherever possible, corridors should preferably be 20m wide or wider.

One hundred and sixteen (116) fauna species (including 10 introduced species) were recorded on the site during this survey (**Appendix B** and **Chart A**). Most native fauna species recorded on the site were birds (73 species), mainly common birds typically found in native vegetation

and semi rural areas of the region. No owls were recorded on the site. Native terrestrial, arboreal and flying mammals (19 species) recorded on the site included Kangaroos, Gliders, Rat, Flying-fox and several species of insectivorous bats. Larger native mammals such as Grey Kangaroos may eventually disappear from bushland on the site. The only small terrestrial native mammal recorded on the site was the common Brown Antechinus and Swamp Rat. A relatively high number (13) of insectivorous bats were recorded on this site. More species of insect bats may be recorded on the site by further survey especially during warmer months. Arboreal mammals, Antechinus and most of the insectivorous bats use tree hollows as den, refuge and breeding habitat and some including threatened species may be using the relatively small number of hollow bearing trees in the study area. A small number of common reptiles were recorded on the site. These included a few species of small skinks, the Blue-tongued Lizard and Bearded Dragon. Further day and night surveys during warmer months are likely to record a few more common reptile species especially snakes on the site. Several species of common frog were recorded on the site, mainly around the ponds and drainage lines in the centre of the site. A few more common frog species are likely to be recorded on the site during warmer and wet weather. Introduced fauna recorded on the site included five (5) species of terrestrial mammals and four (4) species of birds. These included Black Rats, Dogs, Fox, Hare, Rabbits, Feral Pigeon, Turtle-dove, Starling and Indian Myna. Security staff also report seeing Cats on the site. Most of these introduced animals are in relatively low numbers. Dogs appear to visit the site from nearby houses. Foxes were observed during day and night survey and were recorded by trail cameras set on the site. Foxes and Cats probably account for the low number of small native terrestrial fauna that were recorded and the lack of native fauna such as Bandicoots.

Threatened species data from the NSW Bionet database listed 77 threatened flora and fauna species (**Appendix G**) within about 10km of the site. Of these 30 may potentially use habitat on the site and these are addressed in the Assessment of Significance (**Appendix H**). No threatened flora species were recorded on the site during the initial survey. Several (7) threatened fauna species were recorded on the site. Little Lorikeets are highly mobile and nomadic and may have just been moving through the area. They could potentially use hollows as nest habitat in hollow bearing trees on the site. Grey-headed Flying-foxes were recorded near the site and were heard in trees south-east of the site. However, Grey-headed Flying-foxes are likely to forage in eucalypt trees on the site when those trees are in flower and flowering Spotted Gums are especially favoured. They are known to fly over thirty kilometers out from roost camps to forage areas, and back again, each night. A daytime roost "camp" of Grey-headed Flying-foxes was not found on the site or adjacent areas. Grey-headed Flying-foxes and the four threatened insectivorous bats will likely also visit and forage through other forest remnants in the local region. Insectivorous bats are known to fly several kilometers from roost site to forage areas. Squirrel Gliders are confined to the local forest remnants and are dependent on the structural and floristic diversity of vegetation on the site for forage habitat plus hollows for refuge and breeding. They can only safely move between remnants when able to climb between the canopies or glide briefly between trees. If they have to go to ground to move between remnants they then become vulnerable to predators such as Foxes, Dogs and Cats.

Two Endangered Ecological Communities (EEC's) identified on the site are "Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion", mapped as Spotted Gum Ironbark Forest in **Fig-3**, and "Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions", mapped as Red Gum Forest in **Fig-3**. The proposed development is unlikely to **have an adverse effect on the extent** of an ecological community

or to **substantially and adversely modify the composition** of an ecological community such that its local occurrence is likely to be placed at risk of extinction.

The Assessment of Significance (**Appendix H**) found that provided most of the existing forest (EEC) vegetation and hollow bearing trees on the site are retained, with corridors maintaining connection between the remnants, then threatened fauna species and EEC's, recorded on the site, are unlikely to be significantly affected by the proposed development.

5.1 Mitigation measures

Ecological constraints to the proposed development of this site include

- Endangered Ecological Communities
- threatened species
- habitat for threatened species
- hollow bearing trees
- vegetation corridors

To mitigate ecological impacts of the proposed development on threatened species and endangered ecological communities, as much as possible of the existing native forest vegetation, identified as EEC's, and hollow bearing trees on the site must be conserved where possible. Existing native forest remnants on the east and west portions of the site must also be connected to allow easy and safe movement of threatened and common fauna between the remnants. This can be achieved by retaining a corridor of existing native vegetation, of preferred minimum width 20m, along the south and north boundary of the site (**Fig-6**). Hollow bearing trees on the site (**Fig-3**) must also be conserved as nest, den and refuge habitat for hollow dependent fauna, even if retained within APZ's where possible. Any hollow bearing trees removed must be compensated for by replacing hollows with an adequate number of nest boxes, two (2) suitable nest boxes for each hollow, installed in trees in forest nearby on the site. These measures will conserve habitat for threatened fauna species and conserve much of the EEC's.

The usefulness of corridors of vegetation along the south and north boundaries can be maintained by minimising any gaps put through the corridors by roads. Retaining existing native trees and shrubs plus planting additional native trees and shrubs to continue the corridor as close as possible to the road edge will minimize gaps. Additional plantings should be as dense as possible and at least as wide as the corresponding vegetation corridor.

For arboreal mammals such as threatened Squirrel Gliders a gap in a corridor is a point of vulnerability to predators such as Foxes and Cats. Currently there is a gap, where no trees are found, of at least 100m length in the corridor along the south boundary of the site. This should be a continuous corridor, approximately 20m wide, of trees and shrubs, where the tree canopies are close or touching. Ultimately, approximately one third of the existing native forest will be cleared from the site when the entire health precinct is developed. When the staged development of the precinct necessitates clearing of the EECs, the remaining east and west forest remnants should be made more viable habitat for threatened species, such as Squirrel Gliders, by connecting with a complete corridor of vegetation and planting of the breaks identified.

6.0 CONCLUSION

This flora and fauna assessment finds that the old brickworks site at Metford Road, Metford supports an area of highly disturbed and completely cleared land, a partially rehabilitated and weed infested heavily disturbed area of land and remnants of two native forest vegetation communities, parts of which are in relatively good condition (**Fig-3**). Native forest vegetation across the site supports a diversity of native flora species. Hollows in a number of hollow bearing trees on the site provide nest, den and refuge habitat for a range of hollow dependent fauna. Native forest vegetation and hollow bearing trees on the site provide habitat for a variety of threatened and common native fauna many of which were recorded on the site. The site supports a number of man-made ponds and ponds caused by disturbance to a shallow drainage line running northwards across the site (**Fig-3**). These ponds can be modified if required by the proposed development unless the ponds are found to support a population of threatened species, such as Green and Gold Bell Frogs.

The two native forest vegetation communities on the site are Endangered Ecological Communities (EEC's) identified as "Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion" and "Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions".

As much as possible of the native forest vegetation on the site, plus hollow bearing trees, can be retained as habitat for threatened native fauna and to conserve remnants of the Endangered Ecological Communities.

The proposed development, with the adoption of mitigating measures (**5.1**), is unlikely to have a significant impact on threatened species, populations or ecological communities or their habitats.

Further survey for a number of threatened plants and the threatened Green and Gold Bell Frog will be conducted after completion of this report. Results of these additional surveys will be provided as an addendum to this report.

6.1 Recommendations:

1. The proposed development adopt mitigating measures discussed in section **5.1** of this report
2. Retain on the site as much as possible of the native forest vegetation, an EEC
3. Retain on the site as much as possible of the EEC, the native forest vegetation
4. Retain all hollow bearing trees on the site, if any are removed then replace nearby with nest boxes
5. Retain suitably wide corridors of vegetation between forest remnants on the site
6. Sediment and erosion controls should be employed prior to any earth works and construction phases
7. Vehicles, machinery and building refuse associated with construction of the development project should not impinge on areas of retained native forest vegetation.
8. Landscaping on the site should use local native plant species
9. Noxious introduced exotic weeds should be eradicated from the site

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GENERAL FLORA AND FAUNA

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8.0 FIGURES

Figure - 1 Location of study site on topographic map

Figure - 2 Aerial photograph

Figure - 3 General layout of site, vegetation and threatened species

Figure - 4 Trap and survey locations

Figure - 5 Vegetation transects and plots

Figure - 6 Areas of clearing, conserving and corridors

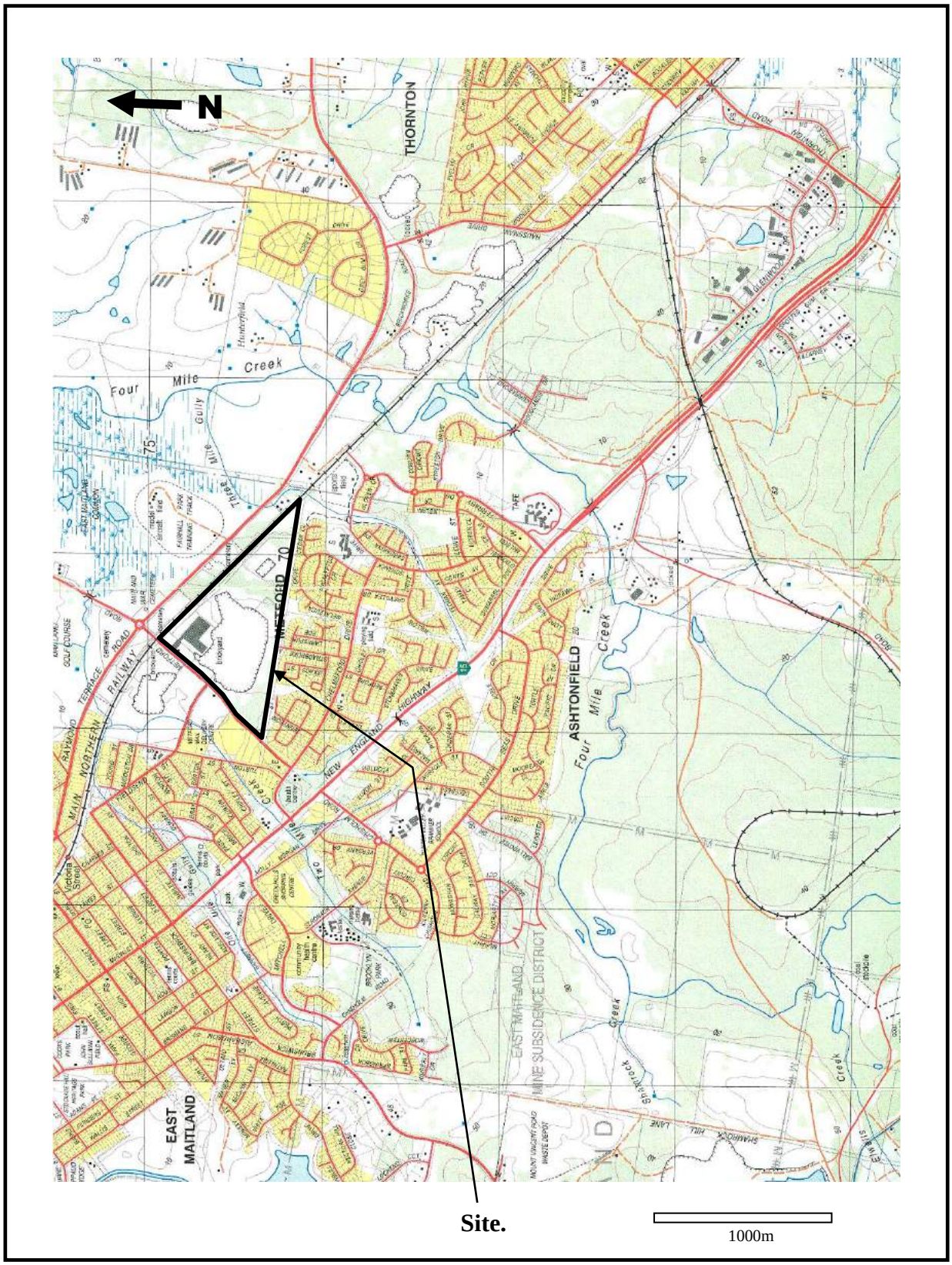

Figure 1 Showing location of site in relation to surrounding areas on a section of topographic map.

scanned from LPI NSW, 1:25 000 topo map, BERESFIELD 9232-3N, 3rd Edn

Figure 2 Aerial photograph showing study site (yellow outline).

Figure - 3

General layout showing approximate distribution of disturbed areas and native vegetation across the site.

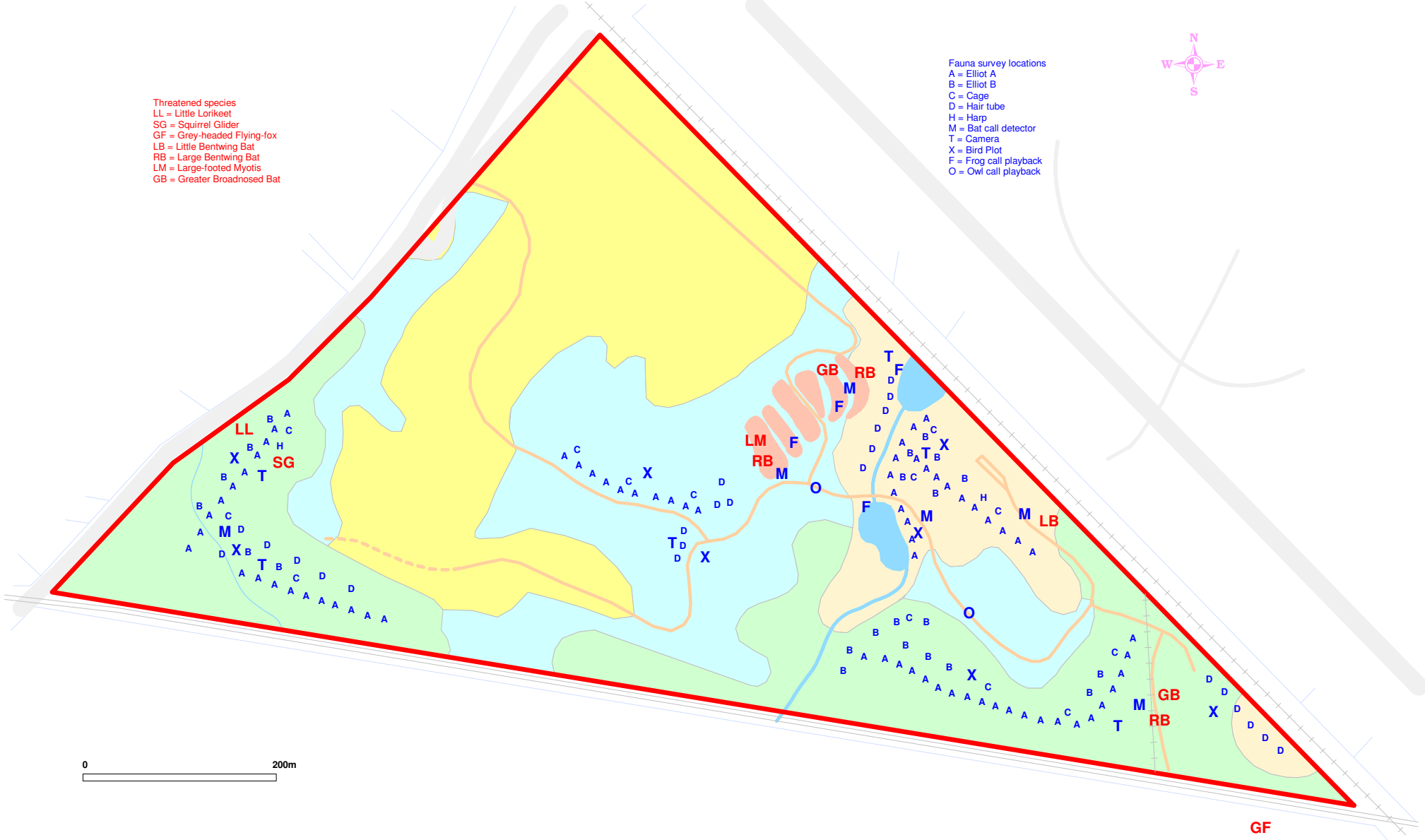

Figure - 4

Fauna survey locations plus location of threatened species recorded on the site.

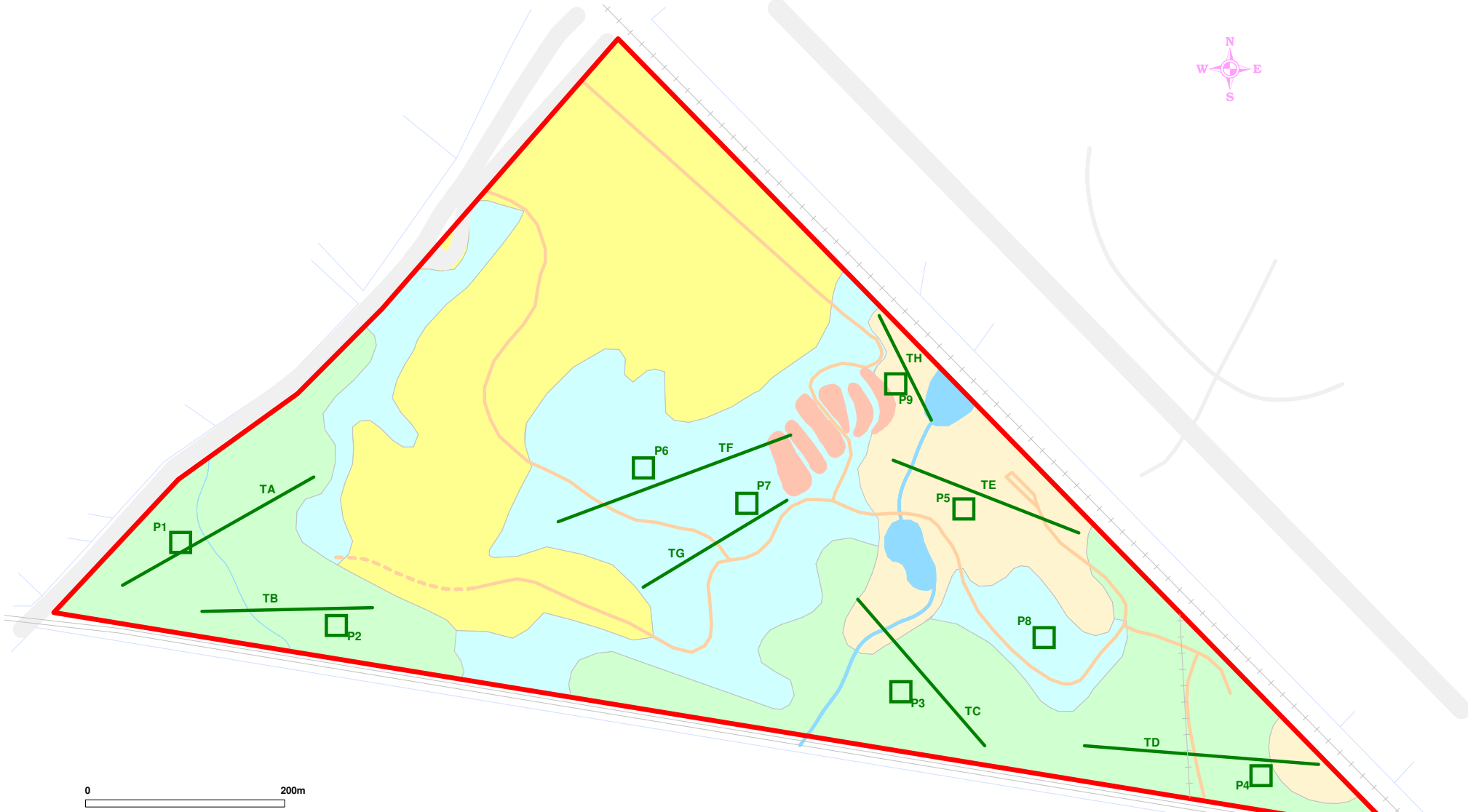

Figure - 5

Vegetation transects (T) and Plots (P) across the site.

Figure - 6

Showing approximate extent of clearing and modification for the proposed development plus extent of proposed partial clearing for Asset Protection Zones. Conserved forest and habitat will be connected by vegetated corridors.

9.0 TABLES

Table-1	Owl-call and Bush Stone-curlew call playback
Table-2	Spotlighting
Table-3	Reptile search
Table-4	Frog search
Table-5	Frog call playback
Table-6	Tracks, scats and signs
Table-7	Bat call detection (Anabatting) results

TABLES

Location - old brickworks site, Metford Road, Metford, NSW

Table-1 Owl and Bush Stone-curlew call playback

Date	Location	Species	Response
16.9.14	Centre east of site	Powerful Owl, Barking Owl, Masked Owl, Sooty Owl & Bush Stone-curlew	• No response
24.9.14	Centre of site	Powerful Owl, Barking Owl, Masked Owl, Sooty Owl & Bush Stone-curlew	• No response

Table-2 Spotlighting

Date	Location	Observations
16.9.14	Throughout vegetated parts of site	• Hare • Rabbit • Grey Kangaroo • Frogs
24.9.14	Throughout vegetated parts of site	• Hare • Rabbit • Feathertail Glider, SW corner • Frogs

Table-3 Reptile search

Date	Location	Method	Observations
9.9.14-12.9.14	Throughout site	Visual searches for reptiles sunning and foraging; turning rubbish, fallen timber and bark; raking in leaf litter, etc.	• Garden Skink • Blur-tongued Lizard • Bearded Dragon • Eastern Water Skink
15.9.14-19.9.14	Throughout site	Visual searches for reptiles sunning and foraging; turning rubbish, fallen timber and bark; raking in leaf litter, etc.	• Garden Skink • Blue-tongued Lizard • Robust Skink • *Carlia tetradactyla* • Eastern Water Skink
23.9.14-25.9.14	Throughout site	Visual searches for reptiles sunning and foraging; turning rubbish, fallen timber and bark; raking in leaf litter, etc.	• Garden Skink • Bearded Dragon • Eastern Water Skink

Table-4 Frog search

Date	Location	Method	Observations
16.9.14 Day & night	Man-made ponds & drainage line ponds	Day and night search of pond edges and pond vegetation and adjacent vegetation; turning bark, logs, leaf litter and rubbish; listening	• *Crinia signifera* • *Litoria fallax* • *Litoria latopalmata* • *Uperoleia laevigata* • *Litoria peroni* • *Limnodynastes tasmaniensis*
18.9.14	Man-made ponds & drainage line ponds	Day and night search of pond edges and pond vegetation and adjacent vegetation; turning bark, logs, leaf litter and rubbish; listening	• *Litoria fallax* • *Litoria latopalmata*
24.9.14 Day & night	Man-made ponds & drainage line ponds	Day and night search of pond edges and pond vegetation and adjacent vegetation; turning bark, logs, leaf litter and rubbish; listening	• *Crinia signifera* • *Litoria fallax* • *Litoria latopalmata* • *Litoria peroni*

Table-5 Frog call playback

Date	Location	Species	Observations
16.9.14	Over man-made ponds & drainage line ponds	Green and Gold Bell Frog (*Litoria aurea*)	• No response
24.9.14	Over man-made ponds & drainage line ponds	Green and Gold Bell Frog (*Litoria aurea*)	• No response

Table-6 Tracks, scats and signs.

Date	Location	Observations
9.9.14-25.9.14	Throughout site	• Grey Kangaroo scats • Rabbit scats • Dog scats • Fox scats • Chewed wattle stems – Yellow-tailed Black Cockatoo

Table-7 Bat call detection (Anabatting) results.

Date of bat call collection	Conditions	Unit	Time	Location	Species recorded
16.9.14	Clear, still, mild	913	1800-2230	Over pond centre of site	• *Vespadelus pumilis* • *Scotorepens orion* • *Chalinolobus gouldii* • *Myotis macropus #* • *Miniopterus schreibersii #* • *Tadarida australis*

16.9.14	Clear, still, mild	914	1800-2230	Red Gum Forest - west	• *Vespadelus vulturnus* • *Vespadelus pumilis* • *Scotorepens orion* • *Nictophyllus sp.* • *Chalinolobus gouldii* • *Chalinolobus morio*
23.9.14	Clear, light breeze, mild	913	1800-0600	Spotted Gum Ironbark Forest south-west corner	• nothing
23.9.14	Clear, light breeze, mild	914	1800-0600	Spotted Gum Ironbark Forest south-east corner	• *Scoteanax rueppellii #* • *Chalinolobus gouldii* • *Miniopterus schreibersii #* • *Vespadelus vulturnus* • *Mormopterus ridei*
24.9.14	Clear, still, warm	913	1800-2230	Over pond north centre of site	• *Chalinolobus gouldii* • *Scoteanax rueppellii #* • *Miniopterus schreibersii #* • *Vespadelus vulturnus* • *Mormopterus ridei*
24.9.14	Clear, still, warm	914	1800-2230	Red Gum Forest - east	• *Scotorepens orion* • *Chalinolobus gouldii* • *Vespadelus vulturnus* • *Miniopterus australis #*

10.0 APPENDICES

Appendix A Flora Species List

Appendix B Fauna Species List

Appendix C Site visit record

Appendix D Vegetation Transect and Plot data

Appendix E Regionally and Locally Significant species and communities

Appendix F EPBC Act matters

Appendix G Threatened species list

Appendix H Assessment of Significance (the **7 Part Test**)

Appendix I Fauna Trapping results

Appendix J Bird Sample Plot results

Appendix K Photographs over site

Appendix L Koala Habitat Assessment

Appendix M Hollow bearing tree locations

Appendix N Threatened species co-ordinates

APPENDIX - A

Flora species list

All plant species on this list were recorded on the site during this survey.

Classification follows that of Flora of New South Wales, Vols 1-4, (Harden, 1990-93).

# = Threatened Species
ssp. = Subspecies, var. = Variety, * = Introd
r = Regionally Significant Plant Species
& = recorded during additional surveys Sep - Dec 2013
n = Noxious weed plant in LGA.

Scientific Name	Common Name	Transect						Plot					
		A	B	C	D	E	F	1	2	3	4	5	6
FILICOPSIDA (Ferns)													
ADIANTACEAE													
Adiantum aethiopicum	Maidenhair Fern			C									
AZOLLACEAE													
Azolla pinnata	Ferny Azolla												
DENSTAEDTIACEAE													
Hypolepis muelleri	Harsh Ground Fern			C		E							
SCHIZAEACEAE													
Cheilanthes sieberi ssp. *sieberi*	Mulga Fern	A	B	C	D	E	F		2		4		
SINOPTERIDACEAE													
Pellaea falcata	Sickle Fern												
*Pellaea viridis**	Green Cliff Brake						F						
THELYPTERIDACEAE													
Christella dentata													
MAGNOLIOPSIDA (Flowering Plants)													
Magnoliidae (Dicotyledons)													
ACANTHACEAE													
Pseuderanthemum variabile	Pastel Flower												
AIZOACEAE													
Carpobrotus glaucescens	Pigface												
*Galenia pubescens**	Galenia												
AMARANTHACEAE													
*Gomphrena celosioides**	Gomphrena Weed												
APIACEAE													
Centella asiatica	Pennywort	A		C			F						6
*Foeniculum vulgare**	Fennel						F						
Hydrocotyle laxiflora		A		C			F						
APOCYNACEAE													
Parsonsia straminea var. *straminea*	Common Silkpod	A	B	C		E		1					
ARALIACEAE													
*Hedera helix**	English Ivy												
*Schefflera actinophylla**	Umbrella Tree												
ASCLEPIADACEAE													
*Gomphocarpus fruiticosus**	Narrow Leaf Cotton Bush												
ASTERACEAE													
*Ageratina adenophora**	Crofton Weed			C		E							
*Ambrosia artemisiifolia**	Ragweed						F						6
*Aster subulatus**	Bushy Starwort												
*Bidens pilosa**	Cobbler's Pegs			C			F						
Cassinia aculeata	Common Cassinia		B										
Chrysanthemoides monilifera ssp. *rotundata**	Bitou Bush	A											
Chrysocephalum apiculatum	Yellow Buttons				D								
*Cirsium vulgare**	Spear Thistle						F						
*Conyza albida**	Tall Fleabane				D		F						
Dimorphotheca ecklonis	Blue and White Daisy Bush												
Epaltes australis	Spreading Nut-heads				D								
*Facelis retusa**													
*Gnaphalium americanum**													
*Hypochaeris radicata**	Flatweed	A				E	F				4		
Ozothamnus diosmifolius	White Dogwood	A	B		D	E	F	1			4	5	6
*Senecio madagascariensis**	Fireweed	A		C	D		F						

Scientific Name	Common Name	Transect						Plot					
		A	B	C	D	E	F	1	2	3	4	5	6
*Senecio pterophorus**	African Daisy						F						
Silybum marianum	Variegated Thistle												
*Soliva sessilis**	Bindii		B										
*Sonchus asper**	Prickly Sowthistle												
*Sonchus oleraceus**	Milk Thistle						F						
*Taraxacum officinale**	Dandelion						F						
Vernonia cinerea var. *cinerea*					D								
BIGNONIACEAE													
*Jacaranda mimosifolia**	Jacaranda		B										
Pandorea pandorana	Wonga Vine	A	B			E		1					
CAESALPINIACEAE													
Senna pendula var. *glabrata**	Senna												
CAMPANULACEAE													
Wahlenbergia gracilis	Native Bluebell				D								
CAPRIFOLIACEAE													
*Lonicera japonica**	Japaneses Honeysuckle												
CARYOPHYLLACEAE													
*Stellaria media**	Chickweed												
CASUARINACEA													
Casuarina glauca	Swamp She-oak						F						
CHENOPODIACEAE													
Einadia hastata	Berry Saltbush		B										
Einadia trigonos	Fishweed												
CONVOLVULACEAE													
Dichondra repens	Kidney Weed												
CRASSULACEAE													
*Bryophyllum delagoense**	Mother-of-millions												
DILLENIACEAE													
Hibbertia pedunculata	Guinea Flower				D		F						
DROSERACEAE													
Drosera peltata	Sundew												
EPACRIDACEAE													
Leucopogon juniperinus	Bearded Heath	A	B			E			2	3			6
EUPHORBIACEAE													
Breynia oblongifolia	Breynia	A				E							
Glochidion ferdinandi	Cheese Tree	A	B	C		E		1	2				6
*Ricinus communis**	Castor Oil Plant												
FABOIDEAE													
Bossiaea prostrata													
Daviesia ulicifolia	Gorse Bitter Pea	A	B	C	D	E	F	1	2		4	5	6
Desmodium rhytidophyllum				C									
Dillwynia retorta	Heathy Parrot Pea	A	B				F			3			
Glycine clandestina	Love Creeper				D				2				
Hardenbergia violacea	False Sasparilla	A	B	C	D	E	F	1		3	4		
Kennedia rubicunda	Dusky Coral Pea						F						6
*Medicago polymorpha**	Burr Medic												
*Medicago sativa**	Lucerne						F						
Oxylobium pulteneae	Wiry Shaggy Pea												
Pultenaea euchila			B										
Pultenaea retusa													
Pultenaea villosa							F						
*Trifolium arvense**	Hares Foot Clover												
*Trifolium repens**	White Clover						F						
Vicia sativa ssp. *sativa**	Vetch						F						
GERANIACEAE													
Geranium homeanum	Cranesbill												
GOODENIACEAE													
Goodenia hederacea var. *hederacea*	Violet-leaved Goodenia	A			D	E							
Goodenia paniculata	Swamp Goodenia						F						
HALORAGACEAE													
Gonocarpus teucrioides	Germander Raspwort												
LAMIACEAE													
*Stachys arvensis**	Stagger Weed												
LAURACEAE													
*Cinnamomum camphora**	Camphor Laurel	A											
LOBELIACEAE													

Scientific Name	Common Name	Transect						Plot					
		A	B	C	D	E	F	1	2	3	4	5	6
Pratia purpurascens	White Root	A	B	C	D	E	F		2	3	4	5	
LORANTHACEAE													
Dendrophthoe vitellina	Mistletoe	A			D	E		1					
MALVACEAE													
*Modiola caroliniana**													
*Pavonia hastata**	Pink Pavonia						F						
*Sida rhombifolia**	Paddy's Lucerne						F						
MELIACEAE													
Melia azedarach var. *australasica*	White Cedar												
MIMOSOIDEAE													
Acacia elongata var. *elongata*		A	B	C	D	E	F	1	2	3	4	5	6
Acacia falcata	Falcate Wattle	A	B	C	D	E	F		2		4	5	
Acacia fimbriata	Fringe Wattle												
Acacia irrorata	Green Wattle	A		C	D	E	F	1				5	6
Acacia longifolia	Sydney Golden Wattle												
Acacia parvipinnula	Silver-stemmed Wattle												
Acacia ulicifolia	Prickly Moses												
MYRTACEAE													
Angophora bakeri							F						6
Angophora costata	Smooth Barked Apple			C									
Angophora floribunda	Rough Barked Apple			C		E							
Callistemon linearis	Narrow-leaved Bottlebrush	A	B					1					
Callistemon sp. hort variety													
Corymbia maculata	Spotted Gum	A	B	C	D	E		1	2	3	4	5	
Eucalyptus amplifolia	Cabbage Gum												
Eucalyptus crebra	Narrow-leaved Ironbark												
Eucalyptus fibrosa ssp. *fibrosa*	Broad-leaved Ironbark	A	B	C	D	E		1		3		5	
Eucalyptus globoidea	White Stringybark	A				E		1					
Eucalyptus nicholii	Narrow-leaved Black Peppermint												
Eucalyptus punctata	Grey Gum	A	B	C				1	2	3			
Eucalyptus siderophloia	Grey Ironbark												
Eucalyptus tereticornis	Forest Red Gum			C	D	E						5	
Kunzea ambigua	Tick Bush												
Leptospermum polygalifolium	Lemon-scented Tea Tree			C		E					4	5	6
Lophostemon confertus	Brush Box												
Melaleuca armillaris ssp. *armillaris*													
Melaleuca linearifolia	Snow In Summer												
Melaleuca nodosa	Ball Honeymyrtle				D		F						6
Melaleuca quinqeunervia	Broad-leaved Paperbark												
Melaleuca sieberi													6
Melaleuca thymifolia					D		F						
OCHNACEAE													
*Ochna serrulata**	Ochna			C									
OLEACEAE													
*Ligustrum sinense**	Small-leaved Privet	A	B			E		1					
Notelaea longifolia	Mock Olive	A	B										
Olea europaea subsp. africana*	Common Olive	A				E							
OXALIDACEAE													
*Oxalis sp.**	Oxalis	A			D								
PHYTOLACCACEAE													
*Phytolacca octandra**	Inkweed												
PITTOSPORACEAE													
Billardiera scandens	Apple Berry				D		F						
Bursaria spinosa	Blackthorn	A	B	C	D	E	F	1	2	3	4	5	
Pittosporum undulatum	Sweet Pittosporum	A	B		D			1	2		4		
PLANTAGINACEAE													
*Plantago lanceolata**	Common Plantain			C	D		F						
POLYGONACEAE													
Persicaria strigosum	Spotted Knotweed												
*Polygonum aviculare**	Wireweed												
*Rumex crispus**	Dock						F						
PORTULACACEAE													
Portulaca oleracea	Pigweed												
PRIMULACEAE													
*Anagallis arvensis**	Scarlet Pimpernel						F						
PROTEACEAE													

Scientific Name	Common Name	Transect						Plot					
		A	B	C	D	E	F	1	2	3	4	5	6
Hakea sericea	Bushy Needlebush	A											
RANUNCULACEAE													
Clematis aristata	Old Mans Beard	A		C		E	F	1				5	
Ranunculus inundatus	River Buttercup												
RHAMNACEAE													
Alphitonia excelsa	Red Ash	A											
ROSACEAE													
*Rubus ulmifolius**	Blackberry	A											
RUBIACEAE													
Pomax umbellata	Pomax												
SANTALACEAE													
Exocarpus cupressiformus	Cherry Ballart		B	C									
SOLANACEAE													
*Cestrum parqui**	Green Cestrum												
*Solanum mauritianum**	Wild Tobacco Bush												
*Solanum nigrum**	Black-berry Nightshade						F						
STYLIDIACEAE													
Stylidium graminifolium	Trigger Plant												
THYMELAEACEAE													
Pimelea linifolia ssp. *linifolia*	Slender Rice Flower						F						
VERBENACEAE													
*Lantana camara**	Lantana	A	B	C	D	E	F	1	2	3		5	6
*Verbena bonariensis**	Purple Top						F						6
Liliidae (Monocotyledons)													
AGAVACEAE													
*Yucca sp**	Yucca												
ANTHERICACEAE													
Caesia parviflora var. *parviflora*	Pale Grass Lily												
Laxmannia gracilis	Slender Wire-lily												
ASPARAGACEAE													
*Protasparagus aethiopicus**	Asparagus Fern	A	B					1					
COMMELINACEAE													
*Tradescantia albiflora**	Wandering Jew			C		E							
CYPERACEAE													
Baumea articulata	Jointed Twig-Rush												6
Bolboschoenus caldwellii							F						
*Cyperus eragrostis**	Umbrella Sedge						F						
Eleocharis sphacelata	Tall Spike-rush												
Eleocharis sp.													
Fimbristylis dichotoma													
Lepidosperma laterale	Sword-sedge			C									
Ptilothryx deusta			B	C	D				2	3			
Schoenoplectus validus							F						
HYDROCHARITACEAE													
Ottelia ovalifolia	Swamp Lily			C									
IRIDACEAE													
Crocosmia X *crocosmiifloria**	Crocosmia												6
Freesia sp.*													
Patersonia sp.	Purple Flag												
Romulea rosea var. *australis**	Onion Grass												
JUNCACEAE													
*Juncus acutus**	Spiny Rush						F						
*Juncus cognatus**													
Juncus krausii	Sea Rush												
Juncus usitatus		A				E	F						6
LOMANDRACEAE													
Lomandra filiformis subsp. *filiformis*			B										
Lomandra longifolia	Mat Rush	A			D		F						6
Lomandra multiflora		A	B	C	D	E		1		3	4		
LUZURIAGACEAE													
Geitonoplesium cymosum	Scrambling Lily	A						1					
ORCHIDACEAE													
Caladenia carnea	Pink Fingers												
Caladenia catenata	White Fingers	A	B	C	D			1		3		5	

Scientific Name	Common Name	Transect						Plot					
		A	B	C	D	E	F	1	2	3	4	5	6
Calochilus sp.	Beard Orchid	A											
Microtis parviflora	Slender Onion Orchid												
PHILYDRACEAE													
Philydrum lanuginosum	Woolly Frogmouth						F						
PHORMIACEAE													
Dianella caerulea	Paroo Lily	A			D	E			2		4		
POACEAE													
*Andropogon virginicus**	Whisky Grass	A					F						6
Aristida ramosa	Three-awned Spear Grass			C	D						4		
Aristida vagans	Three-awned Spear Grass	A	B	C	D	E			2	3	4		
*Arundo donax**	Giant Reed												
*Avena fatua**	Wild Oats												
*Axonopus affinis**	Carpet Grass												
*Briza maxima**	Quaking Grass		B		D		F						
*Briza minor**	Shivery Grass		B										
*Bromus catharticus**	Prairie Grass												
*Chloris gayana**	Rhodes Grass						F						6
*Cortaderia selloana**	Pampas Grass	A				E						5	6
Cymbopogon refractus	Barbed Wire Grass		B		D								
*Cynodon dactylon**	Couch					E	F	1					6
Danthonia tenuior	Wallaby Grass			C	D								
Dichelachne micrantha	Shorthair Plume Grass	A					F						
Digitaria parviflora	Smallflower Fingergrass	A			D								
*Echinochloa crus-gali**	Barnyard Grass												
Echinopogon caespitosus var. *caespitosus*	Tufted Hedgehog Grass		B	C	D				2	3	4		
*Ehrharta erecta**	Panic Veldt Grass												
Entolasia stricta		A	B	C	D	E		1	2	3	4	5	
Eragrostis brownii	Browns Love Grass												
*Eragrostis curvula**	Love Grass												
Eragrostis elongata	Clustered Love Grass	A	B		D		F	1					
*Eragrostis tenuifolia**	Elastic Grass												
Hyparrhenia rufa subsp. *altissima**													
Imperata cylindrica var. *major*	Blady Grass					E							
Microlaena stipoides	Weeping Grass		B	C	D	E					4	5	
Oplismenus aemulus	Basket Grass												
Panicum maximum var. *maximum**	Guinea Grass						F						6
Panicum simile	Two Colour Panic									3			
Paspalidium distans					D								
*Paspalum dilatatum**	Paspalum				D								6
*Paspalum urvillei**	Vasey Grass	A		C	D								6
*Pennisetum clandestinum**	Kikuyu	A						1					
Phragmites australis	Common Reed												6
*Poa annua**	Winter Grass												
Poa labillardieri	Tussock Grass												
*Rhynchelytrum repens**	Red Natal Grass						F						
*Setaria gracilis**	Slender Pigeon Grass						F						
*Setaria palmifolia**	Palm Grass	A											
Sporobolus creber	Slender Rat's Tail Grass				D								
*Stenotaphrum secundatum**	Buffalo Grass												
Stipa pubescens	Tall Speargrass												
Themeda triandra	Kangaroo Grass	A	B	C	D	E		1	2	3	4	5	
*Vulpia bromoides**	Squirrel Tail Fescue												
TYPHACEAE													
Typha orientalis	Cumbungi	A		C		E	F						

APPENDIX - B Fauna species list

The following fauna species are potentially found in the region and may utilise habitat on the study site. Common and threatened species recorded on the site are indicated.

R = Recorded this survey
? = Unconfirmed
= Threatened Species

Scientific Name	Common Name		
MAMMALS			
TACHYGLOSSIDAE			
Tachyglossos aculeatus	Echidna		
DASYURIDAE			
Antechinus stuartii	Brown Antechinus		R
Antechinus swainsonii	Dusky Antechinus		
Dasyurus maculatus	Spotted-tailed Quoll		
Dasyurus viverrinus	Eastern Quoll		
Phascogale tapoatafa	Brush-tailed Phascogale		
Planigale maculata	Common Planigale		
Sminthopsis murina	Common Dunnart		
PERAMELIDAE			
Isoodon macrourus	Northern Brown Bandicoot		
Perameles nasuta	Long-nosed Bandicoot		
PHASCOLARCTIDAE			
Phascolarctos cinereus	Koala		
VOMBATIDAE			
Vombatus ursinus	Common Wombat		
BURRAMYIDAE			
cercartetus nanus	Eastern Pygmy-possum		
PETAURIDAE			
Petaurus breviceps	Sugar Glider		
Petaurus norfolcensis	Squirrel Glider	#	R
PSEUDOCHEIRIDAE			
Pseudocheirus peregrinus	Common Ringtail Possum		
ACROBATIDAE			
Acrobates pygmaeus	Feathertail Glider		R
PHALANGERIDAE			
Trichosurus vulpecula	Common Brushtail Possum		
MACROPODIDAE			
Macropus giganteus	Eastern Grey Kangaroo		R
Macropus rufogriseus	Red-necked Wallaby		
Wallabia bicolor	Swamp Wallaby		
PTEROPODIDAE (FRUIT BATS)			
Pteropus poliocephalus	Grey-headed Flying-fox	#	R
Pteropus scapulatus	Little red Flying-fox		
EMBALLONURIDAE (SHEATHTAIL BATS)			
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat		
RHINOLOPHIDAE (HORSESHOE BATS)			
Rhinolophus megaphyllus	Eastern Horseshoe Bat		
VESPERTILIONIDAE (EVENING BATS)			
Chalinolobus dwyeri	Large-eared Pied Bat		
Chalinolobus gouldii	Gould's Wattled Bat		R
Chalinolobus morio	Chocolate Wattled Bat		R
Miniopterus australis	Little Bentwing Bat	#	R
Miniopterus schreibersii	Large Bentwing Bat	#	R
Myotis macropus	Large-footed Myotis	#	R
Nyctophilus geoffroyi	Lesser Longeared Bat		R

	Scientific Name	Common Name		
	Nyctophilus gouldi	Gould's Longeared Bat		
	Nyctophilus sp.	Longeared Bat		R
	Scoteanax rueppellii	Greater Broadnosed Bat	#	R
	Scotorepens balstoni	Inland Broadnosed Bat		
	Scotorepens orion	Eastern Broadnosed Bat		R
	Vespadelus darlingtoni	Large Forest Bat		
	Vespadelus pumilus	Eastern Forest Bat		R
	Vespadelus regulus	Southern Forest Bat		
	Vespadelus troughtoni	Eastern Cave Bat		
	Vespadelus vulturnus	Little Forest Bat		R
MOLOSSIDAE (FREETAIL BATS)				
	Mormopterus norfolkensis	East-coast Freetail Bat		
	Mormopterus planiceps	Southern Freetail Bat		
	Mormopterus ridei	Eastern Freetail Bat		R
	Nyctinomus australis	White-striped Freetail Bat		R
MURIDAE				
	Hydromys chrysogaster	Water-rat		
	Melomys burtoni	Grassland Melomys		
	*Mus musculus**	House Mouse		
	Pseudomys gracilicaudatus	Eastern Chestnut Mouse		
	Pseudomys novaehollandiae	New Holland Mouse		
	Pseudomys oralis	Hastings River Mouse		
	Rattus fuscipes	Bush Rat		
	Rattus lutreolus	Swamp Rat		R
	*Rattus norvegicus**	Brown Rat		
	*Rattus rattus**	Black Rat		R
CANIDAE				
	*Canis familiaris**	Domestic/feral Dog		R
	Canis lupus dingo	Dingo		
	*Vulpes vulpes**	Fox		R
FELIDAE				
	*Felis catus**	Cat		R
LEPORIDAE				
	*Lepus capensis**	Brown Hare		R
	*Oryctolagus cuniculus**	Rabbit		R
EQUIDAE				
	*Equus caballus**	Horse		
SUIDAE				
	*Sus scrofa**	Pig		
BOVIDAE				
	*Capra hircus**	Goat		
	*Bos taurus**	Cattle		
BIRDS				
CASUARIIDAE				
	Dromaius novaehollandiae	Emu		
MEGAPODIIDAE				
	Alectura lathami	Australian Brush-turkey		
PHASIANIDAE				
	Coturnix pectoralis	Stubble Quail		
	Coturnix ypsilophora	Brown Quail		
	Coturnix chinensis	King Quail		
	*Gallus gallus**	Red Junglefowl (Domestic chicken)		
ANSERANATIDAE				
	Anseranas semipalmata	Magpie Goose		
ANATIDAE				
	Dendrocygna eytoni	Plumed Whistling-duck		

	Scientific Name	Common Name	
	Dendrocygna arcuata	Wandering Whistling-duck	
	Stictonetta naevosa	Freckled Duck	
	Cygnus atratus	Black Swan	
	Tadorna tadornoides	Australian Shelduck	
	Chenonetta jubata	Wood Duck	R
	*Anas platyrhychos**	Mallard	
	Anas superciliosa	Pacific Black Duck	R
	Anas rhynchotis	Australasian Shoveler	
	Anas gracilis	Grey Teal	
	Anas castanea	Chestnut Teal	R
	Anas querquedula	Garganey	
	Malacorhynchus membranaceus	Pink-eared Duck	
	Aythya australis	Hardhead	
PODICIPEDIDAE			
	Tachybaptus novaehollandiae	Australasian Grebe	
	Poliocephalus poliocephalus	Hoary-headed Grebe	
	Podiceps cristatus	Great Crested Grebe	
ANHINGIDAE			
	Anhinga melanogaster	Darter	
PHALACROCORACIDAE			
	Phalacrocorax melanoleucos	Little Pied Cormorant	R
	Phalacrocorax varius	Pied cormorant	
	Phalacrocorax sulcirostris	Little Black Cormorant	
	Phalacrocorax carbo	Great Cormorant	
PELECANIDAE			
	Pelecanus conspicillatus	Australian Pelican	
ARDEIDAE			
	Egretta novaehollandiae	White-faced Heron	R
	Egretta garzetta	Little Egret	
	Egretta sacra	Eastern Reef Egret	
	Ardea pacifica	White-necked Heron	R
	Ardea alba	Great Egret	R
	Ardea intermedia	Intermediate Egret	
	Ardea ibis	Cattle Egret	
	Butorides striatus	Mangrove Heron	
	Nycticorax caledonicus	Nankeen Night Heron	
	Ixobrychus minutus	Little Bittern	
	Ixobrychus flavicollis	Black Bittern	
	Botaurus poiciloptilus	Australasian Bittern	
THRESKIORNITHIDAE			
	Plegadis falcinellus	Glossy Ibis	
	Threskiornis molucca	Australian White Ibis	R
	Threskiornis spinicollis	Straw-necked Ibis	
	Platalea regia	Royal Spoonbill	R
	Platalea flavipes	Yellow-billed Spoonbill	
ACCIPITRIDAE			
	Pandion haliaetus	Osprey	
	Aviceda subcristata	Pacific Baza	
	Elanus axillaris	Black-shouldered Kite	R
	Lophoictinia isura	Square-tailed Kite	
	Milvus migrans	Black Kite	
	Haliastur sphenurus	Whistling Kite	R
	Haliastur indus	Brahminy Kite	
	Haliaeetus leucogaster	White-bellied Sea-eagle	
	Circus assimilis	Spotted Harrier	
	Circus approximans	Swamp Harrier	
	Accipiter fasciatus	Brown Goshawk	R

	Scientific Name	Common Name	
	Accipiter novaehollandiae	Grey Goshawk	
	Accipiter cirrhocephalus	Collared Sparrowhawk	
	Aquila audax	Wedge-tailed Eagle	
	Hieraaetus morphnoides	Little Eagle	
FALCONIDAE			
	Falco berigora	Brown Falcon	
	Falco longipennis	Australian Hobby	R
	Falco subniger	Black Falcon	
	Falco peregrinus	Peregrine Falcon	
	Falco cenchroides	Nankeen Kestrel	R
RALLIDAE			
	Gallirallus philippensis	Buff-banded Rail	
	Rallus pectoralis	Lewins Rail	
	Porzana pusilla	Baillons Crake	
	Porzana fluminea	Australian Spotted Crake	
	Porzana tabuensis	Spotless Crake	
	Porphyrio porphyrio	Purple Swamphen	R
	Gallinula tenebrosa	Dusky Moorhen	
	Fulica atra	Eurasian Coot	
TURNICIDAE			
	Turnix velox	Little Button-quail	
	Turnix varia	Painted Button-quail	
SCOLOPACIDAE			
	Gallinago hardwickii	Lathams Snipe	
BURHINIDAE			
	Burhinus grallarius	Bush Stone-curlew	
RECURVIROSTRIDAE			
	Himantopus himantopus	Pied Stilt	
	Recurvirostra novaehollandiae	Red-necked Avocet	
CHARADRIIDAE			
	Elseyornis melanops	Black-fronted Dotterel	
	Vanellus miles	Masked Lapwing	R
COLUMBIDAE			
	*Columba livia**	Feral Pigeon	R
	Columba leucomela	White-headed Pigeon	
	*Streptopelia chinensis**	Spotted Turtle-dove	R
	Macropygia amboinensis	Brown Cuckoo-dove	
	Chalcophaps indica	Emerald Dove	
	Phaps chalcoptera	Common Bronzewing	
	Phaps elegans	Brush Bronzewing	
	Ocyphaps lophotes	Crested Pigeon	R
	Geopelia cuneata	Diamond Dove	
	Geopelia striata	Peaceful Dove	
	Geopelia humeralis	Bar-shouldered Dove	R
	Leucosarcia melanoleuca	Wonga Pigeon	
	Ptilinopus magnificus	Wompoo Fruit-dove	
	Ptilinopus superbus	Superb Fruit-dove	
	Ptilinopus regina	Rose-crowned Fruit-dove	
	Lopholaimus antarcticus	Topknot Pigeon	
CACATUIDAE			
	Calyptorhynchus lathami	Glossy Black-cockatoo	
	Calyptorhynchus funereus	Yellow-tailed Black-cockatoo	R
	Cacatua roseicapilla	Galah	R
	Cacatua tenuirostris	Long-billed Corella	
	Cacatua sanguinea	Little Corella	R
	Cacatua galerita	Sulphur-crested Cockatoo	R
PSITTACIDAE			

	Scientific Name	Common Name		
	Trichoglossus haematodus	Rainbow Lorikeet		R
	Trichoglossus chlorolepidotus	Scaly-breasted Lorikeet		
	Glossopsitta concinna	Musk Lorikeet		
	Glossopsitta pusilla	Little Lorikeet	#	R
	Alisterus scapularis	King Parrot		R
	Platycercus elegans	Crimson Rosella		
	Platycercus eximius	Eastern Rosella		R
	Lathamus discolor	Swift Parrot		
	Psephotus haematonotus	Red-rumped Parrot		
	Neophema pulchella	Turquoise Parrot		
CUCULIDAE				
	Cuculus saturatus	Oriental Cuckoo		
	Cuculus pallidus	Pallid Cuckoo		
	Cacomantis variolosus	Brush Cuckoo		
	Cacomantis flabelliformis	Fan-tailed Cuckoo		R
	Chrysococcyx osculans	Black-eared Cuckoo		
	Chrysococcyx basalis	Horsefields Bronze-cuckoo		
	Chrysococcyx lucidus	Shining Bronze-cuckoo		R
	Chrysococcyx minutillus	Little Bronze-cuckoo		
	Eudynamys scolopacea	Common Koel		
	Scythrops novaehollandiae	Channel-billed Cuckoo		R
CENTROPODIDAE				
	Centropus phasianinus	Pheasant Coucal		
STRIGIDAE				
	Ninox strenua	Powerful Owl		
	Ninox connivens	Barking Owl		
	Ninox novaeseelandiae	Southern Boobook Owl		
TYTONIDAE				
	Tyto tenebricosa	Sooty Owl		
	Tyto novaehollandiae	Masked Owl		
	Tyto capensis	Grass Owl		
	Tyto alba	Barn Owl		
PODARGIDAE				
	Podargus strigoides	Tawny Frogmouth		R
CAPRIMULGIDAE				
	Eurostopodus mystacalis	White-throated Nightjar		
AEGOTHELIDAE				
	Aegotheles cristatus	Owlet-nightjar		
APODIDAE				
	Hirundapus caudacutus	Spine-tailed Swift		
	Apus pacificus	Fork-tailed Swift		
ALCEDINIDAE				
	Alcedo azurea	Azure Kingfisher		
HALCYONIDAE				
	Dacelo novaeguineae	Laughing Kookaburra		R
	Halcyon macleayii	Forest Kingfisher		
	Todiramphus sanctus	Sacred Kingfisher		R
MEROPIDAE				
	Merops ornatus	Rainbow Bee-eater		
CORACIIDAE				
	Eurystomus orientalis	Dollarbird		R
CLIMACTERIDAE				
	Cormobates leucophaeus	White-throated Treecreeper		
	Climacteris erythrops	Red-browed Treecreeper		
	Climacteris picumnus	Brown Treecreeper		
MALURIDAE				
	Malurus cyaneus	Superb Fairy-wren		R

	Scientific Name	Common Name	
	Malurus lamberti	Variegated Fairy-wren	R
	Stipiturus malachurus	Southern Emu-wren	
PARDALOTIDAE			
	Pardalotus punctatus	Spotted Pardalote	R
	Pardalotus striatus	Striated Pardalote	R
	Sericornis citreogularis	Yellow-throated Scrubwren	
	Sericornis frontalis	White-browed Scrubwren	R
	Sericornis magnirostris	Large-billed Scrubwren	
	Hylacola pyrrhopygia	Chestnut-rumped Heathwren	
	Chthonicola sagittata	Speckled Warbler	
	Smicrornis brevirostris	Weebill	
	Gerygone mouki	Brown Warbler	
	Gerygone olivacea	White-throated Warbler	R
	Acanthiza pusilla	Brown Thornbill	R
	Acanthiza reguloides	Buff-rumped Thornbill	
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	R
	Acanthiza nana	Yellow Thornbill	R
	Acanthiza lineata	Striated Thornbill	R
MELIPHAGIDAE			
	Anthochaera carunculata	Red Wattlebird	R
	Anthochaera chrysoptera	Little Wattlebird	
	Plectorhyncha laceolata	Striped Honeyeater	
	Philemon corniculatus	Noisy Friarbird	R
	Xanthomyza phrygia	Regent Honeyeater	
	Entomyzon cyanotis	Blue-faced Honeyeater	
	Manorina melanophrys	Bell Miner	
	Manorina melanocephela	Noisy Miner	R
	Meliphaga lewinii	Lewins Honeyeater	R
	Lichenostomus chrysops	Yellow-faced Honeyeater	R
	Lichenostomus virescens	Singing Honeyeater	
	Lichenostomus melanops	Yellow-tufted Honeyeater	
	Lichenostomus fuscus	Fuscous Honeyeater	
	Lichenostomus penicillatus	White-plumed Honeyeater	
	Melithreptus gularis	Black-chinned Honeyeater	
	Melithreptus brevirostris	Brown-headed Honeyeater	R
	Melithreptus lunatus	White-naped Honeyeater	R
	Lichmera indistincta	Brown Honeyeater	R
	Grantiella picta	Painted Honeyeater	
	Phylidonyris novaehollandiae	New Holland Honeyeater	
	Phylidonyris nigra	White-cheeked Honeyeater	
	Acanthorhynchus tenuirostris	Eastern Spinebill	R
	Myzomela sanguinolenta	Scarlet Honeyeater	R
	Epthianura albifrons	White-fronted Chat	
PETROICIDAE			
	Microeca fascinans	Jacky Winter	
	Petroica multicolor	Scarlet Robin	
	Petroica rosea	Rose Robin	R
	Eopsaltria australis	Eastern Yellow Robin	
ORTHONYCHIDAE			
	Orthonyx temminckii	Logrunner	
POMATOSTOMIDAE			
	Pomatostomus temporalis	Grey-crowned Babbler	
	Pomatostomus superciliosus	White-browed Babbler	
CINCLOSOMATIDAE			
	Psophodes olivaceus	Eastern Whipbird	
	Cinclosoma punctatum	Spotted Quail-thrush	
NEOSITTIDAE			

	Scientific Name	Common Name	
	Daphoenositta chrysoptera	Varied Sittella	
PACHYCEPHALIDAE			
	Colluricincla harmonica	Grey Shrike-thrush	R
	Falcunculus frontatus	Crested Shrike-tit	
	Pachycephala pectoralis	Golden Whistler	R
	Pachycephala rufiventris	Rufous Whistler	R
DICRURIDAE			
	Monarcha melanopsis	Black-faced Monarch	
	Myiagra rubecula	Leaden Flycatcher	
	Myiagra inquieta	Restless Flycatcher	
	Grallina cyanoleuca	Magpie-lark	R
	Rhipidura rufifrons	Rufous Fantail	
	Rhipidura fuliginosa	Grey Fantail	R
	Rhipidura leucophrys	Willy Wagtail	R
	Dicrurus bracteatus	Spangled Drongo	
CAMPEPHAGIDAE			
	Coracina novaehollandiae	Black-faced Cuckoo-shrike	R
	Coracina papuensis	White-bellied Cuckoo-shrike	
	Coracina tenuirostris	Cicadabird	
	Lalage sueurii	White-winged Triller	
ORIOLIDAE			
	Oriolus sagittatus	Olive-backed Oriole	R
	Sphecotheres viridis	Figbird	R
ARTAMIDAE			
	Artamus leucorynchus	White-breasted Woodswallow	
	Artamus personatus	Masked Woodswallow	
	Artamus superciliosus	White-browed Woodswallow	
	Artamus cyanopterus	Dusky Woodswallow	
	Artamus minor	Little Woodswallow	
	Cracticus torquatus	Grey Butcherbird	R
	Cracticus nigrogularis	Pied Butcherbird	R
	Gymnorhina tibicen	Australian Magpie	R
	Strepera graculina	Pied Currawong	R
	Strepera versicolor	Grey Currawong	
CORVIDAE			
	Corvus coronoides	Australian Raven	R
	Corvus tasmanicus	Forest Raven	
	Corvus mellori	Little Raven	
	Corvus orru	Torresian Crow	
CORCORACIDAE			
	Corcorax melanorhamphos	White-winged Chough	
PTILONORHYNCHIDAE			
	Ailuroedus crassirostris	Green Catbird	
	Sericulus chrysocephalus	Regent Bowerbird	
	Ptilonorhynchus violaceus	Satin Bowerbird	
ALAUDIDAE			
	Mirafra javanica	Singing Bushlark	
	*Alauda arvensis**	Skylark	
MOTACILLIDAE			
	Anthus novaeseelandiae	Richards Pipit	
PASSERIDAE			
	*Passer domesticus**	House Sparrow	
	Taeniopygia guttata	Zebra Finch	
	Taeniopygia bichenovii	Double-barred Finch	R
	Neochmia temporalis	Red-browed Finch	R
	Stagonopleura guttata	Diamond Firetail Finch	
	*Lonchura punctulata**	Nutmeg Mannikin	

	Scientific Name	Common Name	
	Lonchura castaneothorax	Chestnut-breasted Mannikin	
FRINGILLIDAE			
	*Carduelis carduelis**	European Goldfinch	
DICAEIDAE			
	Dicaeum hirundinaceum	Mistletoebird	R
HIRUNDINIDAE			
	Hirundo neoxena	Welcome Swallow	R
	Hirundo nigricans	Tree Martin	
	Hirundo ariel	Fairy Martin	
PYCNONOTIDAE			
	*Pycnonotus jocosus**	Red-whiskered Bulbul	
SYLVIIDAE			
	Acrocephalus stentoreus	Clamorous Reed-warbler	R
	Megalurus timoriensis	Tawny Grassbird	
	Megalurus gramineus	Little Grassbird	
	Cincloramphus mathewsi	Rufous Songlark	
	Cincloramphus cruralis	Brown Songlark	
	Cisticola exilis	Golden-headed Cisticola	
ZOSTEROPIDAE			
	Zosterops lateralis	Silvereye	R
MUSCICAPIDAE			
	Zoothera heinei	Russet-tailed Thrush	
	Zoothera lunulata	Bassian Thrush	
	*Turdus merula**	Blackbird	
STURNIDAE			
	*Sturnus vulgaris**	Starling	R
	*Acridotheres tristis**	Indian Myna	R
REPTILES			
CHELUIDAE			
	Chelodina longicollis	Long-necked Turtle	
	Emydura macquarii gunabarra	Hunter River Turtle	
GEKKONIDAE			
	Diplodactylus vittatus	Stone Gecko	
	Oedura lesueurii	Lesueur's Velvet Gecko	
	Oedura robusta	Robust Velvet Gecko	
	Phyllurus platurus	Southern Leaf-tailed Gecko	
	Underwoodisauris milii	Thick-tailed Gecko	
PYGOPODIDAE			
	Delma plebeia		
	Lialis burtonis	Burton's Legless Lizard	
	Pygopus lepidopodus	Common Scaly-foot	
AGAMIDAE			
	Amphibolurus muricatus	Jacky Lizard	
	Physignathus lesueurii	Eastern Water Dragon	
	Pogona barbata	Bearded Dragon	R
VARANIDAE			
	Varanus varius	Lace Monitor	
SCINCIDAE			
	Acritoscincus platynotum	Red-throated Skink	
	Anomalopus swansoni		
	Anomalopus verreauxi		
	Calyptotis ruficauda		
	Carlia tetradactyla		R
	Carlia vivax		
	Cryptoblepharus virgatus		
	Ctenotus robustus	Robust Skink	R

	Scientific Name	Common Name	
	Ctenotus taeniolatus	Copper-tailed Skink	
	Cyclodomorphus casuarinae	She-oak Skink	
	Egernia cunninghami	Cunninghams Skink	
	Egernia major	Land Mullet	
	Egernia mcpheei		
	Egernia striolata	Tree Skink	
	Egernia whitii	Whites Skink	
	Eulamprus heatwolei		
	Eulamprus quoyii	Eastern Water Skink	R
	Eulamprus tenuis	Yellow-bellied Skink	
	Hemiergis decresiensis		
	Hemisphaeriodon gerrardii	Pink Tongued Skink	
	Lampropholis caligula		
	Lampropholis delicata	Garden Skink	R
	Lampropholis guichenoti	Garden Skink	
	Lygisaurus foliorum		
	Morethia boulengeri		
	Ophioscincus truncatus		
	Pseudemoia entrecasteauxii		
	Pseudemoia platynota	Red-throated Skink	
	Saiphos equalis	Three-toed Skink	
	Saproscincus challengeri	Challengers Skink	
	Saproscincus mustelinus	Weasel Skink	
	Tiliqua scincoides	Blue-tongued Lizard	R
TYPHLOPIDAE			
	Ramphotyphlops nigrescens		
	Ramphotyphlops proximus		
	Ramphotyphlops wiedii		
BOIDAE			
	Morelia spilota spilota	Diamond Python	
COLUBRIDAE			
	Dendrelaphis punctulata	Green Tree Snake	
ELAPIDAE			
	Acanthophis antarcticus	Common Death Adder	
	Austrelaps superbus	Copperhead	
	Cacophis krefftii	Dwarf Crowned Snake	
	Cacophis squamulosus	Golden Crowned Snake	
	Demansia psammophis	Yellow-faced Whip Snake	
	Furina diadema	Red-naped Snake	
	Hemiaspis signata	Black-bellied Swamp Snake	
	Hoplocephalus bitorquatus	Pale-headed Snake	
	Notechis scutatus	Tiger Snake	
	Pseudechis porphyriacus	Red-bellied Black Snake	
	Pseudonaja textilis	Eastern Brown Snake	
	Rhinoplocephalus nigrescens	Eastern Small-eyed Snake	
	Vermicella annulata	Bandy-bandy	
FROGS			
MYOBATRACHIDAE			
	Adelotus brevis	Tusked Frog	
	Crinia signifera	Brown Froglet	R
	Limnodynastes dumerilii	Banjo Frog	
	Limnodynastes ornatus	Ornate Burrowing Frog	
	Limnodynastes peronii	Striped Marsh Frog	R
	Limnodynastes tasmaniensis	Spotted Marsh Frog	R
	Mixophyes fasciolatus	Great Barred Frog	
	Mixophyes balbus	Great Barred Frog	

	Scientific Name	Common Name	
	Mixophyes iteratus	Great Barred Frog	
	Paracrinia haswelli	Haswells Froglet	
	Pseudophryne bibronii	Bibron's Toadlet	
	Pseudophryne coriacea	Red-backed Toadlet	
	Uperoleia fusca	Dusky Toadlet	
	Uperoleia laevigata	Smooth Toadlet	R
	Uperoleia rugosa	Eastern Burrowing Toadlet	
	Uperoleia tyleri	Tyler's Toadlet	
HYLIDAE			
	Litoria aurea	Green and Golden Bell Frog	
	Litoria caerulea	Green Tree Frog	
	Litoria dentata	Bleating Tree Frog	R
	Litoria fallax	Dwarf Green Tree Frog	R
	Litoria freycineti	Freycinet's Frog	
	Litoria gracilenta	Dainty Tree Frog	
	Litoria jervisiensis	Heath Frog	
	Litoria latopalmata	Broad-palmed Frog	R
	Litoria lesueuri	Lesueur's Frog	
	Litoria nasuta	Rocket Frog	
	Litoria peronii	Peron's Tree Frog	R
	Litoria phyllochroa	Green Leaf Tree Frog	
	Litoria tyleri	Tyler's Tree Frog	
	Litoria verreauxii	Verreaux's Tree Frog	
FISH			
POECILIIDAE			
	Gambusia holbrooki	Mosquito Fish	R
ANGUILLIDAE			
	Anguilla reinhardtii	Marbled Eel	
	Anguilla australis	Short-finned Eel	

APPENDIX – C Site Visit Record

Site: old brickworks site, Metford Road, Metford, NSW

Date	Time	Weather conditions	Activity
9.9.14	0800-1530	Part cloud, still, mild-warm	Flora and fauna observations, threatened plant search, koala survey, reptile search, koala search
11.9.14	0800-1600	Clear, light breeze, mild	Flora and fauna observations, threatened plant search, vegetation transects & plots, bird plots, reptile search, koala search
12.9.14	0800-1600	Part cloud, still, mild, later overcast with showers	Flora and fauna observations, threatened plant search, vegetation transects & plots, bird plot, reptile search, koala search
15.9.14	0800-1600	Part cloud, light breeze, warm	Set traps, flora and fauna observations
16.9.14	0700-2230	Light cloud, still, warm, evening clear, still, mild	Check traps, set traps, flora and fauna observations, vegetation transects & plots, day & night frog search, frog call playback, owl call playback, reptile search, spotlighting, bat call collection
17.9.14	0700-1530	Light cloud, light breeze, mild	Check traps, set traps, flora and fauna observations, koala survey, threatened plant search, reptile search
18.9.14	0700-1500	Clear, light breeze, mild to warm	Check traps, flora and fauna observations, koala search, reptile search, threatened plant search, hollow bearing tree survey
19.9.14	0700-1500	Light cloud, light breeze, mild-warm	Check traps, pull in traps (not hair tubes), flora and fauna observations, threatened plant search, hollow bearing tree survey
23.9.14	0700-1600	Clear, still, warm	Set traps, check and pull in hair traps, flora and fauna observations, bat call detecting, reptile search
24.9.14	0700-2400	Clear, still, warm	Check traps, flora and fauna observations, collect bat call detectors, threatened plant search, reptile search, frog search, spotlighting, bat call detecting, night frog search, frog call playback, owl call playback
25.9.14	0800-1600	Light cloud, light breeze, warm	Check harp traps, pull in traps, collect cameras, flora and fauna observations

APPENDIX - D Vegetation Transects and Plots

All vascular plant species observed along and within a few metres of each transect and within each plot are recorded in **Appendix A**. The locations of each transect and plot is indicated in a Figure of this report.

Transect - A

Identification:	TA	**Date:**	12.9.14	**Length:**	~ 220m
Location:	Through forest in south-west portion of site (see Fig)				
Landform:	Slope				
Aspect:	northerly				
Vegetation:	Spotted Gum Ironbark Forest				
Disturbance:	Partial clearing, old tracks, old earthworks, rubbish, weeds				
Comments:	Transect runs across shallow drainage depression that is infested with Privet				

Transect - B

Identification:	TB	**Date:**	11.9.14	**Length:**	~ 170m
Location:	Through forest in south-west portion of site (see Fig)				
Landform:	Slope				
Aspect:	westerly				
Vegetation:	Spotted Gum Ironbark Forest				
Disturbance:	Partial clearing, tracks, old earthworks, rubbish, weeds				
Comments:	This area of vegetation appears in relatively good condition				

Transect - C

Identification:	TC	**Date:**	11.9.14	**Length:**	~ 190m
Location:	Through forest in south-east portion of site (see Fig)				
Landform:	Slope and shallow depression				
Aspect:	North-westerly				
Vegetation:	Spotted Gum Ironbark Forest				
Disturbance:	Partial clearing, weeds				
Comments:	This area of vegetation appears in relatively good condition				

Transect - D

Identification:	TD	**Date:**	11.9.14	**Length:**	~ 230m
Location:	Through forest in south-east portion of site (see Fig)				
Landform:	Slope				
Aspect:	North-easterly				
Vegetation:	Spotted Gum Ironbark Forest and Red Gum Forest				
Disturbance:	Partial clearing, fencing, weeds, rubbish & tracks				
Comments:	This area of vegetation appears in relatively good condition				

Transect - E

Identification:	TE	**Date:**	11.9.14	**Length:**	~ 200m
Location:	Through forest in north-east portion of site (see Fig)				
Landform:	Slope and shallow depression				
Aspect:	Northerly				
Vegetation:	Red Gum Forest				
Disturbance:	Partial clearing, earthworks, weeds, rubbish, tracks				
Comments:	Much of this area appears to have been heavily disturbed				

Transect - F

Identification:	TF	**Date:**	11.9.14	**Length:**	~ 240m
Location:	Through central portion of site (see Fig)				
Landform:	Flats and ponds				
Aspect:	No particular				
Vegetation:	Rehabilitation area, mostly grass and herb weeds, wetland plants				
Disturbance:	Complete clearing, highly disturbed, earthworks, man-made ponds, tracks, rubbish, weeds, replanting				
Comments:	Many of the “native” plants appear to be rehabilitation planting				

Transect - G

Identification:	TG	**Date:**	16.9.14	**Length:**	~ 170m
Location:	Through central portion of site (see Fig)				
Landform:	Flats and ponds				
Aspect:	No particular				
Vegetation:	Rehabilitation area, mostly grass and herb weeds, wetland plants				
Disturbance:	Complete clearing, highly disturbed, earthworks, man-made ponds, tracks, rubbish, weeds, replanting				
Comments:	Many of the “native” plants appear to be rehabilitation planting				

Transect - H

Identification:	TH	**Date:**	16.9.14	**Length:**	~ 190m
Location:	Through forest in north-east portion of site (see Fig)				
Landform:	Disturbed land and ponds				
Aspect:	No particular				
Vegetation:	Red Gum Forest				
Disturbance:	Partial clearing, highly disturbed, earthworks, man-made ponds, tracks, rubbish, weeds, replanting				
Comments:	This area appears to be rehabilitated disturbed land; spoil of mixed soils				

Plot - 1

Identification	P1	**Date**	12.9.14	
Location on site	In forest in south-west portion of site (see Fig)			
Plot size	20 x 20m (400m^2)	**Terrain slope**	Gentle	
Landform element	slope			
Aspect	Northerly	**Soil**	Sandy, clay, loam	
Elevation (asl)	~ 25m	**Erosion**	None obvious	
Surface fragments	Cobbles and pebbles			
Disturbance	Partial clearing, old earthworks, rubbish, weeds			
Weeds	Kikuyu, Lantana, Small-leaved Privet			
Vegetation type	Forest			
Overstorey	**Height**	~ 25m	**% cover**	~ 60 %
Dominants -	Spotted Gum			
Understorey	**Height**	~ 5m	**% cover**	~ 20 %
Dominants -	Blackthorn, immatures of overstorey			
Groundcover	**Height**	~ 0.4m	**% cover**	~ 60 %
Dominants -	*Entolasia stricta*, Common Silkpod			
Comments	This forest area in relatively good condition			

Plot - 2

Identification	P2	**Date**	11.9.14	
Location on site	In forest in south-west portion of site (see Fig)			
Plot size	20 x 20m (400m^2)	**Terrain slope**	Gentle	
Landform element	Slope			
Aspect	Westerly	**Soil**	Sandy, clay, loam	
Elevation (asl)	~ 29m	**Erosion**	None obvious	
Surface fragments	Roots, leaves & sticks			
Disturbance	Partial clearing, weeds			
Weeds	Lantana			
Vegetation type	Forest			
Overstorey	**Height**	~ 20m	**% cover**	~ 80 %
Dominants -	Spotted Gums			
Understorey	**Height**	~ 2m	**% cover**	< 70 %
Dominants -	Blackthorn			
Groundcover	**Height**	~ 0.3m	**% cover**	~ 60 %
Dominants -	*Entolasia stricta, Ptilothryx deusta*			
Comments	This forest area in relatively good condition			

Plot - 3

Identification	P3	**Date**	11.9.14	
Location on site	South-east edge of site			
Plot size	20 x 20m (400m^2)	**Terrain slope**	gentle	
Landform element	slope			
Aspect	North-westerly	**Soil**	Sandy, clay, loam	
Elevation (asl)	~ 21m	**Erosion**	None obvious	
Surface fragments	Roots, leaves & sticks			
Disturbance	Partial clearing, weeds			
Weeds	Lantana			
Vegetation type	Forest			
Overstorey	**Height**	~ 18m	**% cover**	~ 40 %
Dominants -	Spotted Gum, Bastard Mahogany			
Understorey	**Height**	~ 4m	**% cover**	~ 30 %
Dominants -	*Melaleuca nodosa*			
Groundcover	**Height**	~ 0.5m	**% cover**	< 70 %
Dominants -	*Entolasia stricta*			
Comments	This forest area in relatively good condition			

Plot - 4

Identification	P4	**Date**	11.9.14	
Location on site	South-east corner of site			
Plot size	20 x 20m (400m^2)	**Terrain slope**	Gentle	
Landform element	Slope			
Aspect	North-easterly	**Soil**	Sandy, clay, loam	
Elevation (asl)	~ 16m	**Erosion**	None obvious	
Surface fragments	Roots, leaves & sticks			
Disturbance	Partial clearing, weeds			
Weeds	Flatweed			
Vegetation type	Forest			
Overstorey	**Height**	~ 20m	**% cover**	~ 70 %
Dominants -	Spotted Gum			
Understorey	**Height**	~ 2m	**% cover**	< 10 %
Dominants -	Falcate Wattle, *Acacia elongata*			
Groundcover	**Height**	~ 0.6m	**% cover**	~ 70 %
Dominants -	Kangaroo Grass			
Comments	This forest area in relatively good condition			

Plot - 5

Identification	P5	**Date**	11.9.14	
Location on site	Centre north-east of site			
Plot size	20 x 20m (400m^2)	**Terrain slope**	Gentle	
Landform element	Slope			
Aspect	Northerly	**Soil**	Sandy, clay, loam	
Elevation (asl)	~ 16m	**Erosion**	None obvious	
Surface fragments	Cobbles, pebbles, sticks			
Disturbance	Partial clearing, earthworks, weeds			
Weeds	Lantana			
Vegetation type	Forest			
Overstorey	**Height**	~ 15m	**% cover**	~ 70 %
Dominants -	Forest Red Gum			
Understorey	**Height**	~ 3m	**% cover**	~ 60 %
Dominants -	Blackthorn			
Groundcover	**Height**	~ 0.6m	**% cover**	< 50 %
Dominants -	Kangaroo Grass, Weeping Grass			
Comments				

Plot - 6

Identification	P6	**Date**	11.9.14	
Location on site	Centre of site			
Plot size	20 x 20m (400m^2)	**Terrain slope**	Level	
Landform element	Flats			
Aspect	No particular	**Soil**	Mixed, disturbed	
Elevation (asl)	~ 12m	**Erosion**	Heavily disturbed land	
Surface fragments	Cobbles & pebbles			
Disturbance	Complete clearing of natural vegetation, highly disturbed, earthworks, weeds			
Weeds	Many, Rhodes Grass and Guinea Grass			
Vegetation type	Rehabilitation area			
Overstorey	**Height**	~ 5m	**% cover**	< 10 %
Dominants -	*Angophora bakeri*			
Understorey	**Height**	~ 2m	**% cover**	< 20 %
Dominants -	*Acacia parvipinnula, Acacia elongata*			
Groundcover	**Height**	~ 0.8m	**% cover**	~ 100 %
Dominants -	Rhodes Grass, Guinea Grass			
Comments	A highly disturbed area			

Plot - 7

Identification	P7	**Date**	16.9.14	
Location on site	Centre of site			
Plot size	20 x 20m (400m^2)	**Terrain slope**	Level	
Landform element	Flats			
Aspect	No particular	**Soil**	Silt & gravel	
Elevation (asl)	~ 11m	**Erosion**	None obvious	
Surface fragments	Boulders, cobbles and pebbles			
Disturbance	Complete clearing of natural vegetation, highly disturbed, earthworks, man-made pond, weeds			
Weeds	Whisky Grass, Carpet Grass			
Vegetation type	Rehabilitation area			
Overstorey	**Height**	~ 6m	**% cover**	~ 20 %
Dominants -	Forest Red Gum			
Understorey	**Height**	~ 2m	**% cover**	~ 20 %
Dominants -	*Acacia elongata, Acacia parvipinnula*			
Groundcover	**Height**	~ 0.3m	**% cover**	< 20 %
Dominants -	*Entolasia stricta,* Carpet Grass			
Comments	A highly disturbed area			

Plot - 8

Identification	P8	**Date**	16.9.14	
Location on site	South-east centre of site			
Plot size	20 x 20m (400m^2)	**Terrain slope**	Level	
Landform element	Flats			
Aspect	No particular	**Soil**	mixed	
Elevation (asl)	~ 18m	**Erosion**	None obvious	
Surface fragments	Cobbles & pebbles			
Disturbance	Complete clearing of natural vegetation, earthworks, rubbish, weeds			
Weeds	Couch, Whisky Grass, Rhodes Grass			
Vegetation type	Rehabilitation area			
Overstorey	**Height**	None	**% cover**	NA
Dominants -	None			
Understorey	**Height**	~ 2m	**% cover**	< 10 %
Dominants -	*Acacia parvipinnula*			
Groundcover	**Height**	~ 0.4m	**% cover**	~ 90 %
Dominants -	Couch, Whisky Grass, Rhodes Grass			
Comments	Cleared, heavily disturbed, rehabilitation area			

Plot - 9

Identification	P9	**Date**	16.9.14	
Location on site	North centre edge of site (see Fig)			
Plot size	20 x 20m (400m^2)	**Terrain slope**	Level	
Landform element	Bunding between ponds			
Aspect	No particular	**Soil**	Mixed soil	
Elevation (asl)	~ 12m	**Erosion**	Mild at edges	
Surface fragments	Cobbles and pebbles			
Disturbance	Cleared, heavily disturbed, man-made ponds, track, weeds			
Weeds	Rhodes Grass, Lantana			
Vegetation type	Forest			
Overstorey	**Height**	~ 8m	**% cover**	~ 20 %
Dominants -	Forest Red Gum, Swamp She-oak			
Understorey	**Height**	~ 3m	**% cover**	~ 50 %
Dominants -	Blackthorn, Lantana			
Groundcover	**Height**	~ 0.5m	**% cover**	< 50 %
Dominants -	Rhodes Grass, Couch			
Comments	A heavily disturbed area			

APPENDIX – E Regional and Local Significant Matters

The following matters are here addressed –

1. Matters of Regional Significance (Murray *et al*, 2002, p15)
2. Matters of Local Significance (Murray *et al*, 2002, p16)

1.0 Matters of Regional Significance

1.1 Regionally Significant Species

Regionally significant plant species are listed in the Flora and Fauna Survey Guidelines, Lower Hunter, (Murray et al, 2002).

Species of regional significance recorded on the site were –

Flora

Triglochin microtuberosum	Water Ribbons

Fauna

Calyptohynchus funereus	Yellow-tailed Black Cockatoo
Macropus giganteus	Eastern Grey Kangaroo
Vespadelus pumillus	Eastern Forest Bat
Pogona barbata	Eastern Bearded Dragon
Carlia tetradactyla	Southern Rainbow Skink
Limnodynastes tasmaniensis	Spotted Marsh Frog

Water Ribbons was recorded on a man-made pond in the centre east of the site located on a drainage line running from south to north through the site. Habitat for this species will likely be conserved on the site.

Much of the existing forest vegetation and some of the wetlands will be retained on the site as forage, refuge and breeding habitat for the Yellow-tailed Black Cockatoo, Eastern Grey Kangaroo, Eastern Forest Bat, Eastern Bearded Dragon, Southern Rainbow Skink and Spotted Marsh Frog.

The proposed development is unlikely to have a significant impact on matters of regional significance.

1.2 Vegetation communities that have been "heavily cleared"

The following "heavily cleared vegetation community" listed in Appendix 5.7 (Murray *et al*, 2002) may occur on the site.

Hunter Lowland Redgum Forest (MU 19)

Trees representative of this vegetation community are found on the site. Some portions of this vegetation community are heavily disturbed and some areas of this vegetation community may

now be represented by replanting for site rehabilitation purposes. Parts of this vegetation community will be retained and conserved on the site.

1.3 Vegetation communities of less than 1000ha in extent

None of the "vegetation communities of less than 1000 ha extent" listed in Appendix 5.8 (Murray *et al*, 2002) are found on the site.

1.4 Habitat corridors

Aerial photographs show that vegetation in the local region is heavily fragmented by clearing for farm land, roads, rail lines, powerline easements, residential development etc.

Local corridors of vegetation, connecting native vegetation on the site to extensive areas of native vegetation south of the site, are interrupted and tenuous.

A corridor of vegetation can be retained along the south edge of the site as a corridor for the movement of native fauna such as Squirrel Gliders between remnants of native vegetation on the west and east portions of the site.

1.5 Impacts on rainforest vegetation, riparian vegetation and coastal wetlands

This site does not support rainforest vegetation or coastal wetlands.

2.0 Matters of Local Significance

2.1 Unique vegetation associations

No unique vegetation associations are found on this site.

2.2 Significant habitat areas

Investigation and survey work for this report found Squirrel Gliders (*Petaurus norfolkensis*) in forest vegetation on the west portion of the site. Squirrel Gliders were not observed elsewhere on the site but they are likely to use forest vegetation on the east portion of the site. Much of the existing native forest vegetation on the west and east portions of the site, including a number of hollow bearing trees, will be retained as habitat for Squirrel Gliders.

2.3 Habitat trees

The site does support a number of trees bearing cracks, fissures and hollows that may provide refuge, den, nest and breeding habitat for a number of smaller common and threatened species such as insectivorous bats and Squirrel Gliders. The locations and coordinates of these hollow bearing trees are indicated in Figures and Appendices of this report.

Hollow bearing trees will be retained on the site in retained vegetation.

2.4 Specific local population centres of threatened species

The site is not part of an area that is considered a specific local population centre for a particular threatened species.

2.5 Unique geological areas

The site is not considered a unique geological feature and is not adjacent to or near a unique geological feature.

2.6 Local corridor areas

Aerial photographs show that vegetation on the site is not part of a broad corridor of native vegetation connecting similar vegetation elsewhere in the local region.

A habitat corridor of existing and planted native vegetation will be retained along the south edge of this site.

2.7 Significant wetlands

The site does not support a significant wetland nor is the site part of a SEPP 14 Coastal Wetland.

2.8 Local "icon" species or areas

The site does not support a local icon species or area.

2.9 Vegetation communities of "Local Conservation Significance"

Both vegetation communities on the site (**Fig-3**) are identified as endangered ecological communities and as such are dealt with elsewhere in this report.

APPENDIX - F EPBC Act matters

Under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) an action will require approval from the Australian Government Environment Minister if the action has, will have or is likely to have, a significant impact on a matter of National Environmental Significance.

This component of the report will be guided by the Matters of National Environmental Significance – "Significant Impact Guidelines", 1.1 Environment Protection and Biodiversity Conservation Act 1999.

The matters of national environmental significance are:

- World Heritage Properties
- National Heritage Places
- Wetlands of International Importance (Ramsar wetland)
- Nationally Threatened Species and Ecological Communities
- Migratory species (protected under international agreements ie CAMBA & JAMBA)
- Commonwealth Marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mining)
- A water resource, in relation to coal seam gas development and large coal mining development

An EPBC Act Protected Matters Report was generated using the EPBC Act Protected Matters Search Tool on the Department of the Environment and Heritage web site.

Report created:	**21st September 2014**
Search Type:	**Point**
Buffer:	**10 km**
Coordinates:	**-32.75947 151.6077**

Summary

World Heritage Properties:	**None**
National Heritage Places:	**1**
Wetlands of International Importance (Ramsar wetland):	**1**
Commonwealth Marine Areas:	**None**
Threatened Ecological Communities:	**1**
Threatened Species:	**28**
Migratory Species:	**32**

a) World Heritage Properties

Significant Impact Criteria

An action is likely to have a significant impact on the World Heritage values of a declared **World Heritage property** if there is a real chance or possibility that it will cause:

- one or more of the World Heritage values to be lost
- one or more of the World Heritage values to be degraded or damaged
- one or more of the World Heritage values to be notably altered, modified, obscured or diminished

Response to criteria

The site is not part of, adjacent to or within 10km of a World Heritage Property. The proposed development / action is unlikely to have a significant impact on World Heritage values.

b) National Heritage Places

Significant Impact Criteria

An action is likely to have a significant impact on the National Heritage values of a **National Heritage place** if there is a real chance or possibility that it will cause:

- one or more of the National Heritage values to be lost
- one or more of the National Heritage values to be degraded or damaged
- one or more of the National Heritage values to be notably altered, modified, obscured or diminished

Response to criteria

St Peters Anglican Church Group, found on William St, East Maitland, is located over two kilometres (2km) north-west of the old brickworks site at Metford Rd, Metford.

The proposed development / action is unlikely to have a significant impact on National Heritage values.

c) Wetlands of International Importance (Ramsar wetland)

Significant Impact Criteria

An action is likely to have a significant impact on the ecological character of a declared **Ramsar wetland** if there is a real chance or possibility that it will result in:

- areas of the wetland being destroyed or substantially modified
- a substantial and measurable change in the hydrological regime of the wetland, for example, a substantial change to the volume, timing, duration, and frequency of ground and surface water flows to and within the wetland
- the habitat or lifecycle of native species, including invertebrate fauna and fish species, dependent upon the wetland being seriously affected
- a substantial and measurable change in the water quality of the wetland – for example, a substantial change in the level of salinity, pollutants or nutrients in the wetland, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity or human health, or
- an invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland.

Response to criteria

The site is located within 10km of a Ramsar wetland. The **Hunter Estuary Wetlands** are found greater than 8km directly to the south-east of the old brickworks, Metford Rd, Metford site. Surface water flow from the site will likely flow northwards through shallow heavily vegetated wetlands of the East Maitland Common then via Four

Mile Creek northwards into the Hunter River, about 5km north-east of the site. The river then meanders a further greater than 25km east and southwards to the Hunter Estuary Wetlands.

The proposed development / action is unlikely to have a significant impact on a Wetland of International Importance (Ramsar wetland).

d) Commonwealth Marine Areas

Note - the Commonwealth marine area is any part of the sea, including the waters, seabed, and airspace, within Australia's exclusive economic zone and/or over the continental shelf of Australia, that is not State or Northern Territory waters. The Commonwealth marine area stretches from 3 to 200 nautical miles from the coast.

Significant Impact Criteria

An action is likely to have a significant impact on the environment in a **Commonwealth Marine area** if there is a real chance or possibility that it will:

- result in a known or potential pest species becoming established in the Commonwealth marine area
- modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity in a Commonwealth Marine area results
- have a substantial adverse effect on a population of a marine species or cetacean including its life cycle (for example, breeding, feeding, migration behavior, life expectancy) and spatial distribution
- result in a substantial change in air quality or water quality (including temperature) which may adversely impact on biodiversity, ecological integrity; social amenity or human health
- result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity, social amenity or human health may be adversely affected, or
- have a substantial adverse impact on heritage values of the Commonwealth Marine area, including damage or destruction of an historic shipwreck.

Response to criteria

The site is <u>not</u> part of, adjacent to or within 10km of a Commonwealth Marine area. The proposed development / action is unlikely to have a significant impact on a Commonwealth Marine area.

e) Threatened Ecological Communities

Significant Impact Criteria

An action is likely to have a significant impact on a **critically endangered or endangered ecological community** if there is a real chance or possibility that it will:

- reduce the extent of an ecological community
- fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines
- adversely affect habitat critical to the survival of an ecological community
- modify or destroy abiotic (non living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns
- cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting
- cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:
  - assisting invasive species, that are harmful to the listed ecological community, to become established, or
  - causing regular mobilization of fertilizers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of a species in the ecological community, or

- interfere with the recovery of an ecological community.

Response to criteria

The site is not part of a critically endangered or endangered ecological community identified as **White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland**. The proposed development / action is unlikely to have a significant impact on a critically endangered or endangered ecological community.

f) Threatened species

Significant Impact Criteria

An action is likely to have a significant impact on a **critically endangered or endangered species** if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of a population
- reduce the area of occupancy of the species
- fragment an existing population into two or more populations
- adversely affect habitat critical to the survival of a species
- disrupt the breeding cycle of a population
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species habitat
- introduce disease that may cause the species to decline, or
- interfere with the recovery of the species.

Response to criteria

42 threatened species under the EPBC Act are known for the local region within 10km of the study site.

Listed Threatened Species of flora or fauna for which there is potential habitat on the site and that are likely to be recorded on or near the study site include:

Birds		
Xanthomyza Phrygia	Regent Honeyeater	Endangered
Frogs		
Litoria aurea	Green and Golden Bell Frog	Vulnerable
Mammals		
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable
Plants		
Acacia bynoeana	Bynoe's Wattle	Vulnerable
Grevillea parviflora ssp *parviflora*	Small-flower Grevillea	Vulnerable
Persicaria elatior	Knotweed	Vulnerable
Rutidosis heterogama	Heath Wrinklewort	Vulnerable
Tetratheca juncea	Black-eyed Susan	Vulnerable

The Regent Honeyeater visits the coast during times of forage resource shortage in its normal inland NSW range and potentially forage in flowering eucalypts on the site. The proposed development is unlikely to significantly affect this species as much of the existing native forest vegetation will be retained on the site as forage habitat for this species.

Green and Golden Bell Frogs (*Litoria aurea*) could potentially be found in the man-made ponds and wetlands on the site. However, this frog was not recorded on the site during recent survey. The proposed development is unlikely to significantly affect this species, some of the ponds and wetlands will be retained on the site as habitat for this species.

Grey-headed Flying-foxes (*Pteropus poliocephalus*) are likely to use flowering eucalypt trees on the site as forage habitat. No roost "camp" of this species was found or observed on the site or adjacent areas. This species is likely to forage on blossoms in flowering eucalypt trees on the site but roosts in a day time "camp" elsewhere in the local region. Considering that many existing eucalypt trees will be retained in native forest vegetation on the site the proposed development is unlikely to have a significant impact on this species.

No EPBC Act listed threatened plants were found on the site during threatened plant surveys across the site. These flora species are addressed elsewhere in this report resulting in further survey during the flowering period of these plants being conducted across the site. Considering that much of the habitat for these plants will be retained on the site the proposed development is unlikely to have a significant impact on these endangered flora species.

The proposed development / action is unlikely to have a significant impact on critically endangered or endangered species.

g) Migratory Species

Significant Impact Criteria

An action is likely to have a significant impact on a **migratory species** if there is a real chance or possibility that it will:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species
- result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behavior) of an ecologically significant proportion of the population of a migratory species.

Response to criteria

32 migratory species, listed under the EPBC Act, are known for the local region within 10km of the study site. None of the Listed Migratory Species are likely to use the site as forage, refuge or breeding habitat. However, some of the terrestrial migratory species may use the remnants of native forest vegetation as a stepping stone during the migratory period. Much of the existing native forest vegetation on the site will be retained.

The proposed development / action is unlikely to have a significant impact on a migratory species.

APPENDIX - G Threatened species

Data gained from the Bionet website of the NSW Government Office of Environment and Heritage
Records are from within **10km** radius of the study site.

Site - old brickworks site, Metford Road, Metfor 369551 E 6374532 N September 2014

E1 = Schedule 1 Endangered; E2 = Scedule 1, Part 2 Endangered; E4A = Schedule 1A, Part 4, Critically Endangered
V = Schedule 2 Vulnerable.

Y = Yes; P = Potential; N = No

	Scientific name	Common name	Legal Status	Habitat on site	Record on site
Flora					
1	*Cynanchum elegans*	White-flowered Wax Plant	E1	P	N
2	*Rutidosis heterogama*	Heath Wrinklewort	V	Y	N
3	*Tetratheca juncea*	Black-eyed Susan	V	Y	N
4	*Acacia bynoeana*	Bynoe's Wattle	E1	Y	N
5	*Maundia triglochinoides*		V	P	N
6	*Callistemon linearifolius*	Netted Bottle Brush	V	Y	N
7	*Eucalyptus camaldulensis*	Eucalyptus camaldulensis	E2	N	N
8	*Eucalyptus glaucina*	Slaty Red Gum	V	Y	N
9	*Eucalyptus parramattensis ssp. decadens*		V	Y	N
10	*Syzygium paniculatum*	Magenta Lilly Pilly	E1	P	N
11	*Cymbidium canaliculatum*	Cymbidium canaliculatum	E2	N	N
12	*Persicaria elatior*	Tall Knotweed	V	Y	N
13	*Grevillea parviflora ssp. parviflora*	Small-flower Grevillea	V	Y	N
14	*Euphrasia arguta*		E4A	N	N
15	*Zannichellia palustris*		E1	Y	N
Fauna					
16	*Litoria aurea*	Green and Golden Bell Frog	E1	Y	N
17	*Litoria littlejohni*	Littlejohn's Tree Frog	V	N	N
18	*Anseranas semipalmata*	Magpie Goose	V	N	N
19	*Oxyura australis*	Blue-billed Duck	V	N	N
20	*Stictonetta naevosa*	Freckled Duck	V	N	N
21	*Ptilinopus magnificus*	Wompoo Fruit-Dove	V	N	N
22	*Ptilinopus regina*	Rose-crowned Fruit-Dove	V	N	N
23	*Pterodroma solandri*	Providence Petrel	V	N	N
24	*Ephippiorhynchus asiaticus*	Black-necked Stork	E1	N	N
25	*Botaurus poiciloptilus*	Australasian Bittern	E1	P	N
26	*Ixobrychus flavicollis*	Black Bittern	V	P	N
27	*Hamirostra melanosternon*	Black-breasted Buzzard	V	N	N
28	*Hieraaetus morphnoides*	Little Eagle	V	Y	N
29	*Lophoictinia isura*	Square-tailed Kite	V	Y	N
30	*Pandion cristatus*	Eastern Osprey	V	N	N
31	*Falco subniger*	Black Falcon	V	Y	N
32	*Haematopus longirostris*	Pied Oystercatcher	E1	N	N
33	*Irediparra gallinacea*	Comb-crested Jacana	V	N	N
34	*Rostratula australis*	Australian Painted Snipe	E1	N	N
35	*Calidris ferruginea*	Curlew Sandpiper	E1	N	N
36	*Limosa limosa*	Black-tailed Godwit	V	N	N
37	*Sternula albifrons*	Little Tern	E1	N	N
38	*Callocephalon fimbriatum*	Gang-gang Cockatoo	V	N	N
39	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V	N	N
40	*Glossopsitta pusilla*	Little Lorikeet	V	Y	Y
41	*Lathamus discolor*	Swift Parrot	E1	P	N
42	*Neophema pulchella*	Turquoise Parrot	V	N	N
43	*Ninox connivens*	Barking Owl	V	P	N
44	*Ninox strenua*	Powerful Owl	V	Y	N
45	*Tyto longimembris*	Eastern Grass Owl	V	N	N

	Scientific name	Common name	Legal Status	Habitat on site	Record on site
46	*Tyto novaehollandiae*	Masked Owl	V	Y	N
47	*Tyto tenebricosa*	Sooty Owl	V	P	N
48	*Climacteris picumnus victoriae*	Brown Treecreeper (east ssp)	V	N	N
49	*Chthonicola sagittata*	Speckled Warbler	V	P	N
50	*Anthochaera phrygia*	Regent Honeyeater	E4A	Y	N
51	*Epthianura albifrons*	White-fronted Chat	V	N	N
52	*Melithreptus gularis gularis*	Black-chinned Honeyeater (east ssp)	V	Y	N
53	*Pomatostomus temporalis temporalis*	Grey-crowned Babbler (east ssp)	V	Y	N
54	*Daphoenositta chrysoptera*	Varied Sittella	V	Y	N
55	*Petroica boodang*	Scarlet Robin	V	Y	N
56	*Dasyurus maculatus*	Spotted-tailed Quoll	V	P	N
57	*Phascogale tapoatafa*	Brush-tailed Phascogale	V	P	N
58	*Phascolarctos cinereus*	Koala	V	Y	N
59	*Petaurus australis*	Yellow-bellied Glider	V	N	N
60	*Petaurus norfolcensis*	Squirrel Glider	V	Y	Y
61	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	Y	Y
62	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V	Y	N
63	*Mormopterus norfolkensis*	Eastern Freetail-bat	V	Y	N
64	*Chalinolobus dwyeri*	Large-eared Pied Bat	V	Y	N
65	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V	Y	N
66	*Miniopterus australis*	Little Bentwing-bat	V	Y	Y
67	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	V	Y	Y
68	*Myotis macropus*	Southern Myotis	V	Y	Y
69	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V	Y	Y
70	*Vespadelus troughtoni*	Eastern Cave Bat	V	Y	N

APPENDIX - H Assessment of Significance

The Assessment of Significance is also known as the 7 Part Test of s5A *EPA Act 1979*

H1 Questions of the 7 Part Test

The following is taken directly from section 5A of the *Environmental Planning and Assessment Act 1979* and is known as the "**7 Part Test**". Each of the following seven factors (a – g) will be applied in turn to each of the threatened species (**Appendix G**) that are known to inhabit the site or have potential habitat on the site.

5A Significant effect on threatened species, populations or ecological communities, or their habitats.

For the purposes of this Act and, in particular, in the administration of sections 78A, 79C (1) and 112, the following factors must be taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

(a) in the case of a threatened species, whether the action proposed 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 population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(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,

(d) in relation to the habitat of a threatened species, population or ecological community:

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

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

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

H2 Threatened species to be assessed

The factors of s5A of the EPA Act (the **7 Part Test**) are, in this appendix, applied to each of the following threatened species for which there is or may potentially be habitat on the site (see **Appendix G**).

	Scientific name	Common name		Legal Status
1	*Cynanchum elegans*	White-flowered Wax Plant		E1
2	*Rutidosis heterogama*	Heath Wrinklewort		V
3	*Tetratheca juncea*	Black-eyed Susan		V
4	*Acacia bynoeana*	Bynoe's Wattle		E1
5	*Maundia triglochinoides*			V
6	*Callistemon linearifolius*	Netted Bottle Brush		V
8	*Eucalyptus glaucina*	Slaty Red Gum		V
9	*Eucalyptus parramattensis ssp. decadens*			V
10	*Syzygium paniculatum*	Magenta Lilly Pilly		E1
12	*Persicaria elatior*	Tall Knotweed		V
13	*Grevillea parviflora ssp. parviflora*	Small-flower Grevillea		V
15	*Zannichellia palustris*			E1
16	*Litoria aurea*	Green and Golden Bell Frog		E1
25	*Botaurus poiciloptilus*	Australasian Bittern		E1
26	*Ixobrychus flavicollis*	Black Bittern		V
28	*Hieraaetus morphnoides*	Little Eagle		V
29	*Lophoictinia isura*	Square-tailed Kite		V
31	*Falco subniger*	Black Falcon		V
40	*Glossopsitta pusilla*	Little Lorikeet	r	V
41	*Lathamus discolor*	Swift Parrot		E1
43	*Ninox connivens*	Barking Owl		V
44	*Ninox strenua*	Powerful Owl		V
46	*Tyto novaehollandiae*	Masked Owl		V
47	*Tyto tenebricosa*	Sooty Owl		V
49	*Chthonicola sagittata*	Speckled Warbler		V
50	*Anthochaera phrygia*	Regent Honeyeater		E4A
52	*Melithreptus gularis gularis*	Black-chinned Honeyeater (east ssp)		V
53	*Pomatostomus temporalis temporalis*	Grey-crowned Babbler (east ssp)		V
54	*Daphoenositta chrysoptera*	Varied Sittella		V
55	*Petroica boodang*	Scarlet Robin		V
56	*Dasyurus maculatus*	Spotted-tailed Quoll		V
57	*Phascogale tapoatafa*	Brush-tailed Phascogale		V
58	*Phascolarctos cinereus*	Koala		V
60	*Petaurus norfolcensis*	Squirrel Glider	r	V
61	*Pteropus poliocephalus*	Grey-headed Flying-fox	r	V
62	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat		V
63	*Mormopterus norfolkensis*	Eastern Freetail-bat		V
64	*Chalinolobus dwyeri*	Large-eared Pied Bat		V
65	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle		V
66	*Miniopterus australis*	Little Bentwing-bat	r	V
67	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	r	V
68	*Myotis macropus*	Southern Myotis	r	V
69	*Scoteanax rueppellii*	Greater Broad-nosed Bat	r	V
70	*Vespadelus troughtoni*	Eastern Cave Bat		V

r = recorded on site this survey

H3 Application of the 7 Part Test

(a) in the case of a threatened species, whether the action proposed 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,

1. *Cynanchum elegans*

Potentially suitable habitat for this species may be found on the study site. However this species was not found on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This climber, with stems to about 1m long, is found in rainforest gullies, scrub and scree slopes from the Gloucester district to the Wollongong area and inland to Mt Dangar (Harden, 1992).

2. *Rutidosis heterogama* Heath Wrinklewort

Potentially suitable habitat for this species may be found on the site. No individuals of this species were found on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This perennial herb grows mostly in heath, chiefly in coastal districts from Maclean to the Hunter Valley, flowering mainly in autumn (Harden, 1992).

3. *Tetratheca juncea* Black-eyed Susan

Potentially suitable habitat for this species may be found on the site. No individuals of this species were found on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers primarily dense undisturbed understorey vegetation beneath an open forest dominated by *Angophora costata*, *Corymbia gummifera* and *Eucalyptus capitellata* (Payne, 1998). *Tetratheca juncea* appears to favour a southerly or easterly aspect on ridge tops or upper slopes on clayey soils derived from conglomerates beneath dry open forest or woodland dominated by a Smooth-barked Apple/Bloodwood alliance. The species flowers from July to December (Murray *et al*, 2002).

4. *Acacia bynoeana* Bynoe's Wattle

Potentially suitable habitat for this species may be found on the study site. However this species was not found on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This very small shrub prefers heath and dry sclerophyll forests on sandy soils (Harden, 1991) and is readily distinguished from other Acacia species by its branches and phyllodes which are covered with rough coarse hairs. It flowers from September to March, growing in typically very infertile and well drained sandy and sandy clay soils. *Acacia bynoeana* appears to most typically occur on sandy soils derived from Hawkesbury Sandstone in tall open shrubland or low open woodland.

5. *Maundia triglochinoides*

Potentially suitable habitat for this wetland species may occur in ponds on the study site. However this species was not found on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This wetland perennial grows in freshwater swamps and shallow streams (Sainty & Jacobs, 1981) and occurs northwards from about Sydney to Queensland.

6. *Callistemon linearifolius*

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species is found growing in "dry sclerophyll forest on the coast and adjacent ranges, chiefly from the Georges River to the Hawkesbury River" (Harden, 2002). It is also found north to the Nelson Bay area.

8. *Eucalyptus glaucina* Slaty Red Gum

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This Eucalypt is found in grassy woodland on deep, moderately fertile and well watered soil from Taree to Broke (Plantnet - NSW Flora Online).

9. *Eucalyptus parramattensis* Parramatta Red Gum

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This Eucalypt is found in dry sclerophyll woodland on sandy soils in low, often wet sites (Plantnet - NSW Flora Online).

10. *Syzygium paniculatum* Magenta Lilly Pilly

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species grows in subtropical and littoral rainforest on sandy soils or stabilized dunes near the sea at widely separated localities between Bulahdelah and Jervis Bay (Plantnet - NSW Flora Online).

12. *Persicaria elatior* Tall Knotweed

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species grows in damp places, usually on the margin of standing water as very scattered occurrences along coastal NSW and in SE Qld (Plantnet - NSW Flora Online).

13. *Grevillea parviflora* ssp. *Parviflora* Small-flowered Grevillea

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species is known to occur in sandy to clay loam in moist heath or woodland, rarely on sandstone and is found in the regional vegetation type of Coastal Foothills Spotted Gum – Ironbark Forest (Murray *et al*, 2002). It occurs in light clay soils in woodland (NSW Scientific Committee, 1999).

15. *Zannichellia palustris*

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers "fresh to brackish, still to slowly moving waters", (Final determination 980612a). The species prefers semi permanent (standing at least 6 months), open bodies of still or slow moving fresh or brackish water (Personal communications, Mary Greenwood, Hons. student, Newcastle University, studying *Zannichellia palustris***).**

16. *Litoria aurea* Green and Gold Bell Tree Frog

Habitat for this species may be found in ponds on the study site. Some areas of dense reeds and cumbungi are found on the site and permanent or semi permanent open ponds of fresh water are also found on the site. The species was not heard or found after nocturnal and diurnal, searches during dry and wet weather. Some suitable ponds on the site will be retained thereby conserving habitat on the site for this species.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers grassy areas near to open unshaded, still, shallow, ephemeral and unpolluted water bodies with sandy or rocky substrate, aquatic plants such as *Typha sp.* and free of predatory fish, such as *Gambusia sp.* with a range of diurnal shelters including vegetation and rocks (Pyke & White, 1996). The species also spends time exposed, sunning itself.

25. *Botaurus poiciloptilus* Australasian Bittern

Habitat for this species may be found on the study site. Reed beds and fringing vegetation on some ponds on the site may provide habitat for this species although this bird prefers more extensive areas of reed and cumbungi. No individuals of this species were heard or observed or otherwise recorded on the study site during this survey. Some ponds with reed bed areas are likely to be retained thereby conserving habitat on the site for this species.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers water in tall reed beds, sedges, rushes, cumbungi, lignum, drains in tussocky paddocks, saltmarsh, brackish wetlands and is seldom in trees (Pizzey, 1998). Dense and usually extensive reed-beds, especially cumbungi, at margins of lagoons, swamps, sluggish rivers and also tussocky wet paddocks (Serventy, 1985).

26. *Ixobrychus flavicollis* Black Bittern

Potential habitat for this species may be found on the site. This species could forage at the edge of ponds on the study site. This species was not recorded on the study site during this survey. Some ponds are likely to be retained on the site thereby conserving habitat on the site for this species.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species is found in terrestrial wetlands and estuarine and littoral habitats. Forages at edge of still or flowing water usually in permanent wetlands fringed by dense vegetation. It breeds in densely vegetated wetlands in secluded places where nests are built in leafy trees overhanging water (Marchant & Higgins, 1998).

28. *Hieraaetus morphnoides* Little Eagle

Potential forage, refuge and breeding habitat for this species may be found on the site. This species was not recorded on the site during this survey. Much of the existing forest vegetation will be retained on the site thereby conserving potential habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers plains, foothills, open forests, woodlands and scrublands, River Red Gums on watercourses and lakes (Pizzey & Knight, 2007). Typically found in woodlands, forested land and open country extending into arid zones of Australia; feeds mostly on vertebrates, often rabbits; nests in open woodland, mallee and tree lined watercourses (Marchant & Higgins, 1993).

29. *Lophoictinia isura* Square-tailed Kite

Potential forage and breeding habitat for this species may be found on the site. This species was not recorded on the site during this survey. Much of the existing forest vegetation will be retained on the site thereby conserving potential forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers heathlands, woodlands, forests, tropical and subtropical rainforest, timbered watercourses, hills and gorges (Pizzey & Knight, 2007). Typically found in forested and wooded lands of tropical and temperate Australia; many common vegetation associations used; in southern Australia predominantly eucalypt open forest and woodland; feeds mostly on passerines and foliage insects and sometimes small mammals and lizards; nests often near water in forest or open woodland in tree to about 18m (Marchant & Higgins, 1993).

31. *Falco subniger* Black Falcon

Potential forage, refuge and breeding habitat for this species may be found on the site. This species was not recorded on the site during this survey. Much of the existing forest vegetation will be retained on the site thereby conserving potential habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers plains, grasslands, foothills, timbered watercourses and wetland environments (Pizzey & Knight, 2007). Typically found wooded lands, open country and terrestrial wetlands of tropical and temperate Australia; feeds mostly on small terrestrial birds but also mammals, reptiles and insects; nests in large living or dead trees on flat plains or floodplains, isolated trees or in trees fringing creeks and waterholes (Marchant & Higgins, 1993).

40. *Glossopsitta pusilla* Little Lorikeet

Potential forage and breeding habitat for Little Lorikeets may be found on the site. This species was recorded on the study site during this survey. This species will visit flowering eucalypts on the site and trees with potential nest hollows suitable for this species are found on the site. Much of the existing forest vegetation will be retained on the site, including hollow bearing trees, thereby conserving potential forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

Little Lorikeets are nomadic and prefer dry, open eucalypt forests and woodlands, feeding primarily on nectar and pollen of tall flowering eucalypts plus sometimes *Angophora* and *Melaleuca*, plus fruits of mistletoes (Higgins 1999). They nest in hollows mostly in living, smooth-barked eucalypts (Higgins 1999). Can appear at a location at any time of year to feed on flowering eucalypts.

41. *Lathamus discolor* Swift Parrot

Potential forage habitat for this species may be found on the site. Individuals of this species may be transitory visitors to the flowering eucalypts on the site during winter months. During summer it lives and breeds only in Tasmania. No individuals of the species were recorded on the site during this survey. Much of the existing forest vegetation will be retained on the site thereby conserving potential forage habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers timbered country where there are flowering trees and breeds in Tasmania (Readers Digest, 1982). Swift Parrots migrate to the south east parts of the Australian mainland during the winter months and is apparently nomadic in response to food resources then returns to Tasmania to breed during spring and summer (Higgins, 1999). Food for this species is mainly nectar, mostly from eucalypts but also includes psyllids, lerps, seeds and fruit (Higgins, 1999). Swamp Mahogany (*Eucalyptus robusta*) trees are an important winter food source for this species.

43. *Ninnox connivens* Barking Owl

Potential forage and refuge habitat for this species is found on the site. Hollow bearing trees are found on the site and trees with potentially suitable large hollows as breeding or roost habitat for this owl are found on the site. The site may provide suitable forage habitat for this species as part of a larger foraging area. The Barking Owl was not recorded on the site during this survey. Owl call playback during this survey did not elicit a response from this species on or near the site and the species was not heard calling on or near the site. Much of the existing forest vegetation will be retained on the site, including hollow bearing trees, thereby conserving some potential habitat for this species and its prey species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers open forests, woodlands, paperbark woodlands, dense scrubs, foothills, river red gums, other large trees near watercourses in open country (Pizzey, 1998). Ideal habitat for this species is open country with a choice of large trees for roosting and nesting (Hollands, 1991). Barking Owls feed primarily on insects but include birds and mammals such as gliders and rabbits in the diet during breeding when large hollows in live eucalypts are required (Garnett and Crowley, 2000). Feeds mainly on insects outside of breeding season and more birds and mammals during breeding (Higgins, 1999). It appears that most mammals preyed on are smaller arboreal mammals.

44. *Ninox strenua* Powerful Owl

Potential forage and refuge habitat for this species is found on the site. However, tall large trees with suitably large hollows as breeding habitat for this owl are not found on the site. The Powerful Owl was not recorded on the site during this survey. Owl call playback during this survey did not elicit a response from this species on or near the site and the species was not heard calling on or near the site. However, this owl is likely to utilise the site as part of a larger foraging area in search of prey species such as Brush-tailed Possums, Ring-tail Possums, Squirrel Gliders, Kookaburras and Rosellas etc which are likely to be found on the site. Much of the existing forest vegetation on the site will be retained thereby conserving potential forage and refuge habitat for this species and its prey species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers to occupy a large territory of between 300 and 1500 hectares in mountain forests, gullies and forest margins, sparser hilly woodlands, coastal forests, woodlands, scrubs etc (Higgins, 1999). The Powerful Owl always roosts in the open, on a branch, during the day and when roosting in dense vegetation may be low to the ground (Hollands, 1991). Powerful Owls feed mainly on Common Ring-tail Possums and Greater Gliders but also Common Brush-tail Possum, Squirrel Gliders and birds including White Cockatoos (Higgins, 1999). The nest site is typically a large vertical hollow such as broken off trunks of trees but also in horizontal or hollow spouts, usually in living trees but sometimes in dead trees (Higgins, 1999).

46. *Tyto novaehollandiae* Masked Owl

Forage, breeding and refuge habitat for this species may be found on the site. Several hollow bearing trees are found on the site. Larger hollows in trees as refuge and breeding habitat for this owl are found on the site. The Masked Owl was not recorded on the site during this survey. Owl call playback during this survey did not elicit a response from this species on or near the site and the species was not heard calling on or near the site. This owl may utilise the site as part of a larger foraging area in search of typical prey species such as Rats. Much of the existing forest vegetation on the site will be retained, including hollow bearing trees, thereby conserving potential habitat for this species and its prey species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers forests, open woodlands, farmlands with large trees, adjacent cleared country, timbered watercourses, paperbark woodlands and caves (Pizzey & Knight, 2007). The species is mostly recorded in open forest and woodland with a sparse understorey adjacent to open habitats such as cleared farmland, grassland, sedgeland and wetlands etc (Higgins, 1999). Studies indicate that this species will utilise a territory greater than 1000 hectares (Higgins, 1999). Feeds mainly on small to medium terrestrial mammals such as rats but also some arboreal mammal species and birds (Higgins, 1999). Masked Owls nest in "a large hollow in a living or dead tree" (Hollands, 1991) and generally roost in hollows during the day.

47. *Tyto tenebricosa* Sooty Owl

Forage, breeding and refuge habitat for this species may be found on the site. Several hollow bearing trees are found on the site. Larger hollows in trees as refuge and breeding habitat for this owl are found on the site. The Masked Owl was not recorded on the site during this survey. Owl call playback during this survey did not elicit a response from this species on or near the site and the species was not heard calling on or near the site. This owl may utilise the site as part of a larger foraging area in search of typical prey species such as Squirrel Gliders and Rats. Much of the existing forest vegetation on the site will be retained, including hollow bearing trees, thereby conserving potential habitat for this species and its prey species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers tall wet forests in east and south east facing mountain gullies with a dense understorey layer (Pizzey & Knight, 2007); deep moist gullies in eucalypt forest, usually with big, old, smooth-barked gums with an understorey of tree ferns and Lilly Pilly (Hollands, 1991). This species forages for both arboreal species such as Sugar Gliders and terrestrial species such as rats and breeds in larger hollow bearing trees (Newton *et al*, 2002).

49. *Chthonicola sagittata* Speckled Warbler

Potential refuge, forage and breeding habitat for this species may be found on the study site. This species was not recorded on the study site during this survey. Much of the existing forest vegetation on the site will be retained and not disturbed thereby conserving potential refuge, forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This readily observed sedentary species refuges, forages and breeds mainly in drier woodlands with tussocks, fallen logs, branches and rocks (Pizzey & Knight, 2007). Found mainly in grassy ground layer of dry sclerophyll forests and woodlands, often with scattered shrubs in understorey, mainly on slopes of the Great Divide, rarely reported from the coast (Higgins & Peter, 2002).

50. *Xanthomyza Phrygia* Regent Honeyeater

Potential habitat for this species may be found on the study site. This species could potentially be an irregular and transitory visitor to the eucalypts, when in flower, on the study site from its preferred habitat west of the Great Divide. The species was not found on the study site during this survey. It will be recommended to retain areas of native vegetation on the site thereby retaining potential forage habitat for this species.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This migratory species prefers dry open forest and woodlands with a range of eucalypt species, especially ironbarks (Morcombe, 2000), but will also utilise farmland, streets and gardens (Pizzey, 1998). Found mainly on and west of the Great Divide in NSW with few recent records of the species on the coasts although the species will visit the coast, possibly in response to poor food supply in core breeding areas (Higgins *et al*, 2001).

52. *Melithreptus gularis gularis* Black-chinned Honeyeater

Potential habitat for this species may be found on the study site. This species may be an irregular and transitory visitor to the eucalypts, when in flower, on the study site from its preferred habitat west of the Great Divide. The species was not found on the study site during this survey. It will be recommended to retain and not disturb forest vegetation on the site thereby conserving potential habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This nomadic species prefers forest and woodland of eucalypts, paperbarks and tree lined watercourses of arid regions (Morcombe, 2000). This seasonally nomadic species prefers drier eucalypt forests and woodlands, timber on watercourses, often with no understorey, scrubs and Ironbark forests on the western slopes (Pizzey, 1998).

53. ***Pomatostomus temporalis temporalis*** **Grey-crowned Babbler**

Potential refuge, forage and breeding habitat for this species may be found on the study site. This species was not recorded on the study site during this survey. Much of the existing forest vegetation on the site will be retained and not disturbed thereby conserving potential refuge, forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This readily observed sedentary species is found in open forests, woodlands, scrublands, farmlands and outer suburbs (Pizzey & Knight, 2007). Found mainly in open forests and woodlands with an open shrub layer, sparse groundcover, fallen timber and leaf litter (Higgins & Peter, 2002).

54. ***Daphoenositta chrysoptera*** **Varied Sittella**

Potential refuge, forage and breeding habitat for this species may be found on the study site. This species was not recorded on the study site during this survey. Much of the existing forest vegetation on the site will be retained and not disturbed thereby conserving potential refuge, forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This readily observed species is found in open eucalypt forests and woodlands, mallee, inland acacia and coastal tea-tree scrubs (Pizzey & Knight, 2007). Found mainly in eucalypt forests and woodlands, usually with rough-barked trees such as stringybarks and ironbarks (Higgins & Peter, 2002).

55. ***Petroica boodang*** **Scarlet Robin**

Potential refuge, forage and breeding habitat for this species may be found on the study site. This species was not recorded on the study site during this survey. Much of the existing forest vegetation on the site will be retained and not disturbed thereby conserving potential refuge, forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This readily observed species is found in foothill forests, woodlands, watercourses and in autumn and winter more open habitats including golf courses, parks, gardens and orchards (Pizzey & Knight, 2007). Found mainly in eucalypt forests and woodlands with an open understorey, in autumn and winter may disperse to more open habitats including urban areas (Higgins & Peter, 2002).

56. ***Dasyurus maculatus*** **Spotted-tailed Quoll**

Potential forage habitat for this species may be found on the site. Prey species such as birds, reptiles and small mammals, including possums and rats are likely found on the site. The species was not recorded on the site during this survey. A portion of the existing vegetation on the site will be retained thereby conserving potential forage habitat for this species and its prey species on the site.

The life cycle of the species is unlikely to be disrupted such that a viable local population of the species would be placed at risk of extinction.

This nocturnal species prefers rainforest, open forest, woodland and coastal heathland (Strahan, 1998) and requires hollow logs, caves or rock crevices as shelter and breeding dens. The Spotted-tailed Quoll is an opportunistic carnivore that preys on birds, reptiles and small mammals, including gliders, possums and rats etc and also scavenges on carrion (NSW DECC Threatened Species profile).

57. *Phascogale tapoatafa* Brush-tailed Phascogale

Potentially suitable habitat for this species may be found on the study site. Hollows potentially suitable for this species are found on the site. Brush-tailed Phascogales were not recorded on the study site during this survey. Much of the existing forest vegetation on the site will not be disturbed by the proposed development thereby conserving potential refuge, forage and breeding habitat for this species on the site. However, considering the isolation of vegetation on the site from extensive areas of native vegetation then this species is unlikely to be found on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers open forest with sparse ground cover (Strahan, 1995) and dry sclerophyll forest and open woodlands that contain hollow bearing trees (Maxwell *et al*, 1996). The carnivorous and nocturnal Brush-tailed Phascogale forages, preferentially in rough barked trees, for prey such as spiders, centipedes, beetles and cockroaches plus nectar and occasionally small vertebrates (NSW DECC Threatened Species profile).

58. *Phascolarctos cinereus* Koala

Potential forage and refuge habitat for this species is found on the study site. Preferred koala feed trees are found on the site. However, no koalas or signs of koalas were observed on the site during this survey. There are only two (2) records in the Bionet wildlife database of koalas within 5km of the site. Much of the existing forest vegetation on the site including Koala feed trees, will not be disturbed by the proposed development thereby conserving potential habitat for this species on the site. However, considering the isolation of vegetation on the site from extensive areas of native vegetation then this species is unlikely to be found on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development on the site such that a viable local population of the species would be placed at risk of extinction.

This species has a widespread but patchy distribution in eastern NSW (Ellis & Etheridge, 1993) and is usually associated with eucalypt forests throughout the range with marked local and regional preferences for various eucalypt species as feed trees (Strahan, 1998). Koala home ranges can vary from male to female and depending on the palatability and nutritional value of the feed trees. They are generally from less than 2 to greater than 3 hectares but in areas of low preferred tree densities can be up to 100 hectares (Martin and Handasyde, 1999). Koalas are known to feed on a wide variety of eucalypt and other tree species however in Schedule 2 of SEPP No 44 is a list of ten "primary koala feed trees".

66. *Petaurus norfolkensis* Squirrel Glider

Potential forage, refuge, breeding and den habitat for this species is found on the site. Squirrel Gliders were recorded during trapping and spotlighting surveys on this site. Trees with potentially suitable hollows for this species as den or breeding habitat are found on the site and the site contains vegetation with mixed aged eucalypt trees with a range of species and understorey shrubs including wattles as forage habitat for this species. Much of the existing native forest vegetation on the site, including hollow bearing trees, will be retained thereby conserving forage, refuge and breeding habitat for this species on the site. Corridors of vegetation will be retained between the forest patches on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers open forest or woodland with hollow bearing, mature or mixed aged stands with several eucalypt species (Murray, 1996). It inhabits dry sclerophyll forest and woodland and is absent from dense coastal ranges (Strahan, 1998). It forages in eucalypt trees and shrubs such as wattles primarily for insects (Menkhorst, 1995) but also sap, nectar and pollen and utilises old trees with hollows for den habitat (Strahan, 1998). This glider "is known to travel up to 1km from foraging areas to a preferred hollow" (Menkhorst, 1995).

61. *Pteropus poliocephalus* Grey-headed Flying-fox

Forage habitat for this species is found on the site. Grey-headed Flying-foxes were heard on nearby land during this survey. Grey-headed Flying-foxes are likely to forage in flowering eucalypt trees, especially Spotted Gums, when these trees are in flower on the site. The site does not support a daytime roost (camp) of this species. A portion of the existing forest vegetation on the site will be retained thereby conserving forage habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species feeds on the blossoms of a large range of eucalypt and non-eucalypt tree and shrub species; rainforest fruit species comprise a small proportion of the diet of flying-foxes in NSW (Eby, 1995). Grey-headed Flying-foxes roost in large numbers during the day in "camps" that have a history of irregular or permanent use over many years (Eby, 1995). This bat will fly over 30km from the camp to foraging areas (Menkhorst, 1995).

62. *Saccolaimus flaviventris* Yellow-bellied Sheathtailed-Bat

Forage habitat for this species may be found over the study site. Potentially suitable hollow bearing trees are found on the site for this species to breed and roost in. Open areas on the site are available for this species as forage habitat and forage habitat is available on farmland and wetland areas north of the site. This species was not recorded on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This widespread species forages for insects above the canopy and roosts in tree hollows (Strahan, 1998). Insectivorous bats are known to travel widely from roost trees to favoured forage areas.

63. *Mormopterus norfolkensis* Eastern Freetail Bat

Forage, roost and breeding habitat for this species is found on the site. This species was not recorded on the site during this survey. Some hollow bearing trees on the site could potentially be used by this species as roost and breeding habitat. Much of the existing forest vegetation on the site, including hollow bearing trees, will be retained thereby conserving forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species forages in dry eucalypt forest and woodland (Strahan, 1998). The species apparently roosts in tree hollows and forages in openings and gaps in the forest (Churchill, 1998). Very little is known about this species.

64. *Chalinolobus dwyeri* Large-eared Pied Bat

Forage habitat for this species may be found on the site. This species was not recorded on the site during this survey. There are no caves or mines on the site in which individuals or a population would roost or breed. Much of the existing vegetation on the site will be retained thereby conserving forage habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species forages in tall open eucalypt forest, dry sclerophyll forest, woodland, wet sclerophyll forest and rainforest and roosts predominantly in caves and mines (Churchill, 1998).

65. *Falsistrellus tasmaniensis* Eastern False Pipistrelle

Potential habitat for this species may be found on the site although the species is more common at higher elevations. Individuals or a population of the species may forage about the tree canopy of the study site or utilise the hollow bearing trees on the site for roosting or breeding. This species was not recorded on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species inhabits sclerophyll forests, at cool elevations (Strahan, 1995). It forages within or just below the tree canopy, from the ranges to the coast and prefers wet habitats where trees are more than 20m high and generally roost in hollow trunks of eucalypt trees though they have been recorded in caves (Churchill, 1998).

66. *Miniopterus australis* Little Bent-wing Bat

Forage habitat for this species may be found on the site. This species was recorded on the site during this survey. There are no caves, mines or large culverts on the site in which individuals or a population would roost or breed.

Much of the existing forest vegetation on the site will be retained thereby conserving forage habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species forages, between the shrub and canopy layers, in tall open eucalypt forest, dry sclerophyll forest, woodland, wet sclerophyll forest, rainforest and melaleuca swamps and roosts and breeds in caves and mines (Churchill, 1998).

67. *Miniopterus schreibersii oceanensis* Large Bent-wing Bat

Forage habitat for this species may be found on the site. This species was recorded on the site during this survey, however, there are no caves or mines on the site in which individuals or a population would roost or breed. Much of the existing vegetation on the site will be retained thereby conserving forage habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This fast flying species forages, above the canopy layer, in tall open eucalypt forest, dry sclerophyll forest, woodland, wet sclerophyll forest, rainforest, melaleuca swamps and over grasslands and roosts and breeds in caves, mines and culverts (Churchill, 1998).

68. *Myotis macropus* Southern Myotis

Forage habitat for this species may be found in the study area. This species was recorded over ponds on the site during this survey. There are no caves, mines or large culverts on the study site in which individuals or a population would roost and breed. This species will forage over open water on ponds on the site and may roost in culverts of drains etc nearby or caves and mines in the local region. Some of the ponds with open water will likely be retained on the site, however, there are other open surface water ponds in the local area over which this species may forage.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species forages for insects over streams and pools in mangroves, paperbark swamps, rainforest, wet and dry sclerophyll forest and open woodland. The species roosts in caves but is also known to roost in tree hollows, vegetation, Pandanus, under bridges, in mines, tunnels and stormwater drains (Churchill, 1998).

69. *Scoteanax rueppellii* Greater Broad-nosed Bat

Forage, roost and breeding habitat for this species is found on the site. This species was recorded on the site during this survey. Some hollow bearing trees on the site could potentially be used by this species as roost and breeding habitat. Much of the existing forest vegetation on the site, including hollow bearing trees, will be retained thereby conserving forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This slow flying species forages within 20m of the ground along tree lines often adjacent to cleared paddocks and prefers moist gullies in mature coastal forest but also forages in gullies of dry sclerophyll forest, woodland, wet sclerophyll forest and roosts in hollow tree trunks and branches (Churchill, 1998).

46. *Vespadelus troughtoni* Eastern Cave Bat

Forage habitat for this species may be found on the study site. This species was not recorded on the site during this survey. There are no caves or mines on the study site in which individuals or a population would roost or breed. Much of the existing forest vegetation on the site will be retained thereby conserving forage habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species forages in tall open eucalypt forest, dry sclerophyll forest, woodland, wet sclerophyll forest and rainforest and roosts predominantly in caves and mines (Churchill, 1998).

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

No threatened flora or fauna species found within 10km of the study site are part of an "endangered population" cited in Schedule 1, Part 2 Endangered Populations of the TSC Act 1995.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(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,

The site does not support a "Critically Endangered Ecological Community" (CEEC) as listed under Schedule 1A, Part 2 of the TSC Act 1995.

According to vegetation mapping (LHCCREMS, 2003) and ground investigations the site does support an "Endangered Ecological Community" (EEC) identified under Part 3 of Schedule 1 of the TSC Act 1995.

The site supports two EEC's, these are identified as

- **Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion**
- **Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions**

Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion is found on the south-east and south-west corner portions and along much of the south edge of the site (**Fig-3**). Much of this EEC is in relatively good condition and will be conserved by the proposed development. Some already disturbed parts at the edges of this EEC may be cleared or partially cleared for an Asset Protection Zone. Of the approximately 13.6 hectares of SGIF on the site about 3.9 hectares (28.7%) of SGIF would be cleared or disturbed by the APZ (as indicated in a plan provided 30.9.14). Clearing of approximately 3.9 hectares of this EEC from the site is an insignificant portion of the Regional (26,917 hectare) and Local (1204 hectare) occurrence of this EEC as of 2000. As of 2000, according to the Maitland Greening Plan (MCC, 2002), approximately 1204 hectares (9.5%) of the local pre 1750 extent of this EEC remained. A recommendation in the Maitland Greening Plan suggests the Conservation outcome for this EEC should be "No Net Loss".

Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions is found either side of a shallow drainage depression in the centre north portion of the site (indicated as Red Gum Forest in **Fig-3**). Most of this EEC appears to have undergone some form of disturbance. Some heavily disturbed parts at the edges of this EEC may be cleared or partially cleared for an Asset Protection Zone. Much of the EEC will be retained by the proposed development. Most of the areas of this EEC to be cleared by the APZ are already

degraded or on disturbed land. The main core of this community on the site will be retained. Of the approximately 4.7 hectares of Red Gum Forest on the site about 2.0 hectares (42%) would be cleared or disturbed by the APZ (as indicated in a plan provided 30.9.14). Clearing of approximately 2.0 hectares of this EEC from the site is an insignificant portion of the Regional (4,856 hectare) and Local (670 hectare) occurrence of this EEC as of 2000. According to the Maitland Greening Plan (MCC, 2002), approximately 670 hectares (15%) of the local pre 1750 extent of this EEC remained as of 2000. A recommendation in the Maitland Greening Plan suggests the Conservation outcome for this EEC should be "No Net Loss".

The proposed development is unlikely to **have an adverse effect on the extent** of an ecological community such that its local occurrence is likely to be placed at risk of extinction.

The proposed development is unlikely to **substantially and adversely modify the composition** of an ecological community such that its local occurrence is likely to be placed at risk of extinction.

(d) in relation to the habitat of a threatened species, population or ecological community:

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

According to plans provided, the proposed development will retain about 80% of the Spotted Gum Ironbark Forest and about 60% of the Red Gum Forest (**Fig-3**) on the north, east and west portions of the site. About one third of the existing native forest vegetation on the site will be removed or modified as a result of the proposed action.

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

Connectivity will be retained between areas of retained native forest vegetation on the east and west portions of the site. There are no corridors to forest vegetation north of the site and only broken corridors to vegetation off the south of the site. Land surrounding the site is already heavily cleared and fragmented. An area of habitat is unlikely to become fragmented or isolated from other areas of habitat as a result of the proposed action

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

The relatively small area of forest vegetation proposed to be cleared for development on the site is unlikely to be significant or important to local threatened species, populations and ecological communities. However, it is here recognised that the cumulative impact of clearing many small areas of native vegetation over time is likely to be significant.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The site and adjacent areas are not "critical habitat" as described and listed in the Register of Critical Habitat kept by the Director General of the Department of Environment and Conservation.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There are few State or Federal recovery plans (draft or final) available for threatened species in the local region and none available for threatened insectivorous bats. For the following species that may be affected by the proposed development recovery plans are available –

- Grey-headed Flying-fox
- Koala
- Regent Honeyeater
- Large forest owls

Conserving much of the native vegetation on the site is likely to be consistent with the objectives of recovery plans for the above mentioned species.

Threat abatement plans are available for –

- Red Fox
- Bitou Bush
- Plague Minnow

These species were found or are already likely to be found on or near the site, however, the proposed development is unlikely to introduce or intentionally encourage these species into the area.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The following Key Threatening Processes are listed in Schedule 3 of the Threatened Species Conservation Act 1995.

I. **Alteration of habitat following subsidence due to longwall mining** – the proposed development is not longwall mining and will not cause alteration of habitat following subsidence due to longwall mining

II. **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands** – the proposed development is unlikely to alter flow regimes of creeks, rivers and streams.

III. **Anthropogenic Climate Change** – clearing of a small area of vegetation from the site is unlikely to contribute significantly to anthropogenic climate change. However the cumulative impact of clearing many small areas may have a significant impact. It will be recommended to minimize clearing.

IV. **Bushrock removal** – It will be recommended to not disturb natural bushrock where not necessary and not to remove natural bushrock from the site.

V. **Clearing of native vegetation** - Loss of the small area of native vegetation from the site for the proposed development is unlikely to immediately threaten the survival or evolutionary development of species, populations or ecological communities or their habitats. However clearing of vegetation from the study site may contribute over time to the cumulative impact of native vegetation loss and fragmentation in the local area.

VI. **Competition and grazing by feral European Rabbit, *Oryctolagus cuniculus*** – the proposed development is unlikely to intentionally cause the introduction of feral rabbits into the local area. Feral rabbits are already found on the site.

VII. **Competition and habitat degradation by Feral Goats, *Capra hircus*** - the proposed development is unlikely to intentionally cause the introduction of feral Goats into the local area.

VIII. **Competition from feral honey bees, *Apis mellifera*** - the proposed development is unlikely to intentionally cause the release of feral honey bees into the local area.

IX. **Death or injury to marine species following capture in shark control programs on ocean beaches** – not applicable.

X. **Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments** – the proposed development is unlikely to release anthropogenic debris into the marine or estuarine environment.

XI. **Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners** – the proposed development is unlikely to intentionally encourage psyllids and Bell Miners onto the site.

XII. **Herbivory and environmental degradation caused by feral deer** - the proposed development is unlikely to intentionally encourage or release deer onto the site.

XIII. **High frequency fire** – the proposed development is unlikely to introduce a high fire regime to native vegetation in the local area.

XIV. **Importation of Red Imported Fire Ants *Solenopsis invicta*** – the proposed development is unlikely to intentionally or knowingly import Red Fire Ants into the local area

XV. **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations** – the proposed development is unlikely to intentionally cause infection of psittacine (parrot) species in the local area with Psittacine Circoviral Disease.

XVI. **Infection of frogs by amphibian chytrid causing the disease chytridiomycosis** – the proposed development is unlikely to cause the intentional spread of chytridiomycosis.

XVII. **Infection of native plants by *Phytophthora cinnamomi*** - the proposed development is unlikely to intentionally cause infection of native plants by *Phytophthora cinnamomi* in the local area

XVIII. **Introduction of the Large Earth Bumblebee *Bombus terrestris*** – the proposed development is unlikely to intentionally cause the introduction of the Large Earth Bumblebee into the local environment.

XIX. **Invasion and establishment of Scotch Broom (*Cytisus scoparius*)** - the proposed development is unlikely to intentionally infect the site with Scotch Broom.

XX. **Invasion and establishment of Lantana (*Lantana camara*)** – the site already contains extensive patches of Lantana.

XXI. **Invasion and establishment of Cane Toad (*Bufo marinus*)** – these amphibians are not found on the site and the proposed development is unlikely to cause the introduction of Cane Toads to the site or local area.

XXII. **Exotic Vines and Scramblers** – A small number of exotic vines and scramblers are already found on the site. The proposed development will be encouraged to not use exotic plants in gardens and as landscaping for the site.

XXIII. **Invasion of native plant communities by African Olive (*Olea europaea*)** - the proposed development is unlikely to intentionally introduce African Olive to native vegetation on the site or the local area. This plant is already found on the site.

XXIV. **Invasion of native plant communities by *Chrysanthemoides monilifera*** - the proposed development is unlikely to intentionally introduce *C. monilifera* to native vegetation on the site or the local area. This plant is already found on the site.

XXV. **Invasion of native plant communities by exotic perennial grasses** – exotic perennial grasses are already present on the site, especially in disturbed areas of the site.

XXVI. **Invasion of the Yellow Crazy Ant, (*Anoplolepis gracilipes*) -** the proposed development is unlikely to intentionally introduce Yellow Crazy Ants to native vegetation on the site or the local area.

XXVII. **Loss of hollow bearing trees** – the proposed development will minimize the number of hollow bearing trees disturbed or removed.

XXVIII. **Loss or degradation (or both) of sites used for hill-topping by butterflies** – the proposed development is unlikely to destroy vegetation on higher ground that may be utilised by butterflies for hill-topping.

XXIX. **Predation and hybridisation by Feral Dogs, (*Canis lupus familiaris*)** – the proposed development is unlikely to intentionally cause predation and hybridisation by feral dogs.

XXX. **Predation by *Gambusia holbrooki* (Plague Minnow or Mosquito Fish) -** the Plague Minnow is already present in ponds on the site but is unlikely to be further encouraged or protected by the proposed development.

XXXI. **Predation by the European Red Fox *Vulpes Vulpes*** – the Fox is already present in the local area but is unlikely to be further encouraged or protected by the proposed development.

XXXII. **Predation by the Feral Cat *Felis catus* -** the Feral Cat is likely already present in the local area but is unlikely to be further encouraged or protected by the proposed development.

XXXIII. **Predation by the Ship Rat *Rattus rattus* on Lord Howe Island** – not applicable.

XXXIV. **Predation, habitat degradation, competition and disease transmission by Feral Pigs *Sus scrofa*** – The proposed development is unlikely to cause the introduction or spread of feral pigs into the local area.

XXXV. **Removal of dead wood and dead trees** – the proposed development is likely to cause the removal of some dead wood on the ground and small dead trees from that part of the site being developed.

APPENDIX - H Assessment of Significance

The Assessment of Significance is also known as the 7 Part Test of s5A *EPA Act 1979*

H1 Questions of the 7 Part Test

The following is taken directly from section 5A of the *Environmental Planning and Assessment Act 1979* and is known as the "**7 Part Test**". Each of the following seven factors (a – g) will be applied in turn to each of the threatened species (**Appendix G**) that are known to inhabit the site or have potential habitat on the site.

5A Significant effect on threatened species, populations or ecological communities, or their habitats.

For the purposes of this Act and, in particular, in the administration of sections 78A, 79C (1) and 112, the following factors must be taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

(a) in the case of a threatened species, whether the action proposed 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 population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(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,

(d) in relation to the habitat of a threatened species, population or ecological community:

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

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

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

H2 Threatened species to be assessed

The factors of s5A of the EPA Act (the **7 Part Test**) are, in this appendix, applied to each of the following threatened species for which there is or may potentially be habitat on the site (see **Appendix G**).

	Scientific name	Common name		Legal Status
1	*Cynanchum elegans*	White-flowered Wax Plant		E1
2	*Rutidosis heterogama*	Heath Wrinklewort		V
3	*Tetratheca juncea*	Black-eyed Susan		V
4	*Acacia bynoeana*	Bynoe's Wattle		E1
5	*Maundia triglochinoides*			V
6	*Callistemon linearifolius*	Netted Bottle Brush		V
8	*Eucalyptus glaucina*	Slaty Red Gum		V
9	*Eucalyptus parramattensis ssp. decadens*			V
10	*Syzygium paniculatum*	Magenta Lilly Pilly		E1
12	*Persicaria elatior*	Tall Knotweed		V
13	*Grevillea parviflora ssp. parviflora*	Small-flower Grevillea		V
15	*Zannichellia palustris*			E1
16	*Litoria aurea*	Green and Golden Bell Frog		E1
25	*Botaurus poiciloptilus*	Australasian Bittern		E1
26	*Ixobrychus flavicollis*	Black Bittern		V
28	*Hieraaetus morphnoides*	Little Eagle		V
29	*Lophoictinia isura*	Square-tailed Kite		V
31	*Falco subniger*	Black Falcon		V
40	*Glossopsitta pusilla*	Little Lorikeet	r	V
41	*Lathamus discolor*	Swift Parrot		E1
43	*Ninox connivens*	Barking Owl		V
44	*Ninox strenua*	Powerful Owl		V
46	*Tyto novaehollandiae*	Masked Owl		V
47	*Tyto tenebricosa*	Sooty Owl		V
49	*Chthonicola sagittata*	Speckled Warbler		V
50	*Anthochaera phrygia*	Regent Honeyeater		E4A
52	*Melithreptus gularis gularis*	Black-chinned Honeyeater (east ssp)		V
53	*Pomatostomus temporalis temporalis*	Grey-crowned Babbler (east ssp)		V
54	*Daphoenositta chrysoptera*	Varied Sittella		V
55	*Petroica boodang*	Scarlet Robin		V
56	*Dasyurus maculatus*	Spotted-tailed Quoll		V
57	*Phascogale tapoatafa*	Brush-tailed Phascogale		V
58	*Phascolarctos cinereus*	Koala		V
60	*Petaurus norfolcensis*	Squirrel Glider	r	V
61	*Pteropus poliocephalus*	Grey-headed Flying-fox	r	V
62	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat		V
63	*Mormopterus norfolkensis*	Eastern Freetail-bat		V
64	*Chalinolobus dwyeri*	Large-eared Pied Bat		V
65	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle		V
66	*Miniopterus australis*	Little Bentwing-bat	r	V
67	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	r	V
68	*Myotis macropus*	Southern Myotis	r	V
69	*Scoteanax rueppellii*	Greater Broad-nosed Bat	r	V
70	*Vespadelus troughtoni*	Eastern Cave Bat		V

r = recorded on site this survey

H3 Application of the 7 Part Test

(a) in the case of a threatened species, whether the action proposed 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,

1. *Cynanchum elegans*

Potentially suitable habitat for this species may be found on the study site. However this species was not found on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This climber, with stems to about 1m long, is found in rainforest gullies, scrub and scree slopes from the Gloucester district to the Wollongong area and inland to Mt Dangar (Harden, 1992).

2. *Rutidosis heterogama* Heath Wrinklewort

Potentially suitable habitat for this species may be found on the site. No individuals of this species were found on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This perennial herb grows mostly in heath, chiefly in coastal districts from Maclean to the Hunter Valley, flowering mainly in autumn (Harden, 1992).

3. *Tetratheca juncea* Black-eyed Susan

Potentially suitable habitat for this species may be found on the site. No individuals of this species were found on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers primarily dense undisturbed understorey vegetation beneath an open forest dominated by *Angophora costata*, *Corymbia gummifera* and *Eucalyptus capitellata* (Payne, 1998). *Tetratheca juncea* appears to favour a southerly or easterly aspect on ridge tops or upper slopes on clayey soils derived from conglomerates beneath dry open forest or woodland dominated by a Smooth-barked Apple/Bloodwood alliance. The species flowers from July to December (Murray *et al*, 2002).

4. *Acacia bynoeana* Bynoe's Wattle

Potentially suitable habitat for this species may be found on the study site. However this species was not found on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This very small shrub prefers heath and dry sclerophyll forests on sandy soils (Harden, 1991) and is readily distinguished from other Acacia species by its branches and phyllodes which are covered with rough coarse hairs. It flowers from September to March, growing in typically very infertile and well drained sandy and sandy clay soils. *Acacia bynoeana* appears to most typically occur on sandy soils derived from Hawkesbury Sandstone in tall open shrubland or low open woodland.

5. *Maundia triglochinoides*

Potentially suitable habitat for this wetland species may occur in ponds on the study site. However this species was not found on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This wetland perennial grows in freshwater swamps and shallow streams (Sainty & Jacobs, 1981) and occurs northwards from about Sydney to Queensland.

6. *Callistemon linearifolius*

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species is found growing in "dry sclerophyll forest on the coast and adjacent ranges, chiefly from the Georges River to the Hawkesbury River" (Harden, 2002). It is also found north to the Nelson Bay area.

8. *Eucalyptus glaucina* Slaty Red Gum

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This Eucalypt is found in grassy woodland on deep, moderately fertile and well watered soil from Taree to Broke (Plantnet - NSW Flora Online).

9. *Eucalyptus parramattensis* Parramatta Red Gum

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This Eucalypt is found in dry sclerophyll woodland on sandy soils in low, often wet sites (Plantnet - NSW Flora Online).

10. *Syzygium paniculatum* Magenta Lilly Pilly

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species grows in subtropical and littoral rainforest on sandy soils or stabilized dunes near the sea at widely separated localities between Bulahdelah and Jervis Bay (Plantnet - NSW Flora Online).

12. *Persicaria elatior* Tall Knotweed

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species grows in damp places, usually on the margin of standing water as very scattered occurrences along coastal NSW and in SE Qld (Plantnet - NSW Flora Online).

13. *Grevillea parviflora* ssp. *Parviflora* Small-flowered Grevillea

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species is known to occur in sandy to clay loam in moist heath or woodland, rarely on sandstone and is found in the regional vegetation type of Coastal Foothills Spotted Gum – Ironbark Forest (Murray *et al*, 2002). It occurs in light clay soils in woodland (NSW Scientific Committee, 1999).

15. *Zannichellia palustris*

Potentially suitable habitat for this species may be found on the study site. However the species was not recorded on the study site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers "fresh to brackish, still to slowly moving waters", (Final determination 980612a). The species prefers semi permanent (standing at least 6 months), open bodies of still or slow moving fresh or brackish water (Personal communications, Mary Greenwood, Hons. student, Newcastle University, studying *Zannichellia palustris***).**

16. *Litoria aurea* Green and Gold Bell Tree Frog

Habitat for this species may be found in ponds on the study site. Some areas of dense reeds and cumbungi are found on the site and permanent or semi permanent open ponds of fresh water are also found on the site. The species was not heard or found after nocturnal and diurnal, searches during dry and wet weather. Some suitable ponds on the site will be retained thereby conserving habitat on the site for this species.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers grassy areas near to open unshaded, still, shallow, ephemeral and unpolluted water bodies with sandy or rocky substrate, aquatic plants such as *Typha sp.* and free of predatory fish, such as *Gambusia sp.* with a range of diurnal shelters including vegetation and rocks (Pyke & White, 1996). The species also spends time exposed, sunning itself.

25. *Botaurus poiciloptilus* Australasian Bittern

Habitat for this species may be found on the study site. Reed beds and fringing vegetation on some ponds on the site may provide habitat for this species although this bird prefers more extensive areas of reed and cumbungi. No individuals of this species were heard or observed or otherwise recorded on the study site during this survey. Some ponds with reed bed areas are likely to be retained thereby conserving habitat on the site for this species.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers water in tall reed beds, sedges, rushes, cumbungi, lignum, drains in tussocky paddocks, saltmarsh, brackish wetlands and is seldom in trees (Pizzey, 1998). Dense and usually extensive reed-beds, especially cumbungi, at margins of lagoons, swamps, sluggish rivers and also tussocky wet paddocks (Serventy, 1985).

26. *Ixobrychus flavicollis* Black Bittern

Potential habitat for this species may be found on the site. This species could forage at the edge of ponds on the study site. This species was not recorded on the study site during this survey. Some ponds are likely to be retained on the site thereby conserving habitat on the site for this species.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species is found in terrestrial wetlands and estuarine and littoral habitats. Forages at edge of still or flowing water usually in permanent wetlands fringed by dense vegetation. It breeds in densely vegetated wetlands in secluded places where nests are built in leafy trees overhanging water (Marchant & Higgins, 1998).

28. *Hieraaetus morphnoides* Little Eagle

Potential forage, refuge and breeding habitat for this species may be found on the site. This species was not recorded on the site during this survey. Much of the existing forest vegetation will be retained on the site thereby conserving potential habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers plains, foothills, open forests, woodlands and scrublands, River Red Gums on watercourses and lakes (Pizzey & Knight, 2007). Typically found in woodlands, forested land and open country extending into arid zones of Australia; feeds mostly on vertebrates, often rabbits; nests in open woodland, mallee and tree lined watercourses (Marchant & Higgins, 1993).

29. *Lophoictinia isura* Square-tailed Kite

Potential forage and breeding habitat for this species may be found on the site. This species was not recorded on the site during this survey. Much of the existing forest vegetation will be retained on the site thereby conserving potential forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers heathlands, woodlands, forests, tropical and subtropical rainforest, timbered watercourses, hills and gorges (Pizzey & Knight, 2007). Typically found in forested and wooded lands of tropical and temperate Australia; many common vegetation associations used; in southern Australia predominantly eucalypt open forest and woodland; feeds mostly on passerines and foliage insects and sometimes small mammals and lizards; nests often near water in forest or open woodland in tree to about 18m (Marchant & Higgins, 1993).

31. *Falco subniger* Black Falcon

Potential forage, refuge and breeding habitat for this species may be found on the site. This species was not recorded on the site during this survey. Much of the existing forest vegetation will be retained on the site thereby conserving potential habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers plains, grasslands, foothills, timbered watercourses and wetland environments (Pizzey & Knight, 2007). Typically found wooded lands, open country and terrestrial wetlands of tropical and temperate Australia; feeds mostly on small terrestrial birds but also mammals, reptiles and insects; nests in large living or dead trees on flat plains or floodplains, isolated trees or in trees fringing creeks and waterholes (Marchant & Higgins, 1993).

40. *Glossopsitta pusilla* Little Lorikeet

Potential forage and breeding habitat for Little Lorikeets may be found on the site. This species was recorded on the study site during this survey. This species will visit flowering eucalypts on the site and trees with potential nest hollows suitable for this species are found on the site. Much of the existing forest vegetation will be retained on the site, including hollow bearing trees, thereby conserving potential forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

Little Lorikeets are nomadic and prefer dry, open eucalypt forests and woodlands, feeding primarily on nectar and pollen of tall flowering eucalypts plus sometimes *Angophora* and *Melaleuca*, plus fruits of mistletoes (Higgins 1999). They nest in hollows mostly in living, smooth-barked eucalypts (Higgins 1999). Can appear at a location at any time of year to feed on flowering eucalypts.

41. *Lathamus discolor* Swift Parrot

Potential forage habitat for this species may be found on the site. Individuals of this species may be transitory visitors to the flowering eucalypts on the site during winter months. During summer it lives and breeds only in Tasmania. No individuals of the species were recorded on the site during this survey. Much of the existing forest vegetation will be retained on the site thereby conserving potential forage habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers timbered country where there are flowering trees and breeds in Tasmania (Readers Digest, 1982). Swift Parrots migrate to the south east parts of the Australian mainland during the winter months and is apparently nomadic in response to food resources then returns to Tasmania to breed during spring and summer (Higgins, 1999). Food for this species is mainly nectar, mostly from eucalypts but also includes psyllids, lerps, seeds and fruit (Higgins, 1999). Swamp Mahogany (*Eucalyptus robusta*) trees are an important winter food source for this species.

43. *Ninnox connivens* Barking Owl

Potential forage and refuge habitat for this species is found on the site. Hollow bearing trees are found on the site and trees with potentially suitable large hollows as breeding or roost habitat for this owl are found on the site. The site may provide suitable forage habitat for this species as part of a larger foraging area. The Barking Owl was not recorded on the site during this survey. Owl call playback during this survey did not elicit a response from this species on or near the site and the species was not heard calling on or near the site. Much of the existing forest vegetation will be retained on the site, including hollow bearing trees, thereby conserving some potential habitat for this species and its prey species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers open forests, woodlands, paperbark woodlands, dense scrubs, foothills, river red gums, other large trees near watercourses in open country (Pizzey, 1998). Ideal habitat for this species is open country with a choice of large trees for roosting and nesting (Hollands, 1991). Barking Owls feed primarily on insects but include birds and mammals such as gliders and rabbits in the diet during breeding when large hollows in live eucalypts are required (Garnett and Crowley, 2000). Feeds mainly on insects outside of breeding season and more birds and mammals during breeding (Higgins, 1999). It appears that most mammals preyed on are smaller arboreal mammals.

44. *Ninox strenua* Powerful Owl

Potential forage and refuge habitat for this species is found on the site. However, tall large trees with suitably large hollows as breeding habitat for this owl are not found on the site. The Powerful Owl was not recorded on the site during this survey. Owl call playback during this survey did not elicit a response from this species on or near the site and the species was not heard calling on or near the site. However, this owl is likely to utilise the site as part of a larger foraging area in search of prey species such as Brush-tailed Possums, Ring-tail Possums, Squirrel Gliders, Kookaburras and Rosellas etc which are likely to be found on the site. Much of the existing forest vegetation on the site will be retained thereby conserving potential forage and refuge habitat for this species and its prey species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers to occupy a large territory of between 300 and 1500 hectares in mountain forests, gullies and forest margins, sparser hilly woodlands, coastal forests, woodlands, scrubs etc (Higgins, 1999). The Powerful Owl always roosts in the open, on a branch, during the day and when roosting in dense vegetation may be low to the ground (Hollands, 1991). Powerful Owls feed mainly on Common Ring-tail Possums and Greater Gliders but also Common Brush-tail Possum, Squirrel Gliders and birds including White Cockatoos (Higgins, 1999). The nest site is typically a large vertical hollow such as broken off trunks of trees but also in horizontal or hollow spouts, usually in living trees but sometimes in dead trees (Higgins, 1999).

46. *Tyto novaehollandiae* Masked Owl

Forage, breeding and refuge habitat for this species may be found on the site. Several hollow bearing trees are found on the site. Larger hollows in trees as refuge and breeding habitat for this owl are found on the site. The Masked Owl was not recorded on the site during this survey. Owl call playback during this survey did not elicit a response from this species on or near the site and the species was not heard calling on or near the site. This owl may utilise the site as part of a larger foraging area in search of typical prey species such as Rats. Much of the existing forest vegetation on the site will be retained, including hollow bearing trees, thereby conserving potential habitat for this species and its prey species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers forests, open woodlands, farmlands with large trees, adjacent cleared country, timbered watercourses, paperbark woodlands and caves (Pizzey & Knight, 2007). The species is mostly recorded in open forest and woodland with a sparse understorey adjacent to open habitats such as cleared farmland, grassland, sedgeland and wetlands etc (Higgins, 1999). Studies indicate that this species will utilise a territory greater than 1000 hectares (Higgins, 1999). Feeds mainly on small to medium terrestrial mammals such as rats but also some arboreal mammal species and birds (Higgins, 1999). Masked Owls nest in "a large hollow in a living or dead tree" (Hollands, 1991) and generally roost in hollows during the day.

47. *Tyto tenebricosa* Sooty Owl

Forage, breeding and refuge habitat for this species may be found on the site. Several hollow bearing trees are found on the site. Larger hollows in trees as refuge and breeding habitat for this owl are found on the site. The Masked Owl was not recorded on the site during this survey. Owl call playback during this survey did not elicit a response from this species on or near the site and the species was not heard calling on or near the site. This owl may utilise the site as part of a larger foraging area in search of typical prey species such as Squirrel Gliders and Rats. Much of the existing forest vegetation on the site will be retained, including hollow bearing trees, thereby conserving potential habitat for this species and its prey species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers tall wet forests in east and south east facing mountain gullies with a dense understorey layer (Pizzey & Knight, 2007); deep moist gullies in eucalypt forest, usually with big, old, smooth-barked gums with an understorey of tree ferns and Lilly Pilly (Hollands, 1991). This species forages for both arboreal species such as Sugar Gliders and terrestrial species such as rats and breeds in larger hollow bearing trees (Newton *et al*, 2002).

49. *Chthonicola sagittata* Speckled Warbler

Potential refuge, forage and breeding habitat for this species may be found on the study site. This species was not recorded on the study site during this survey. Much of the existing forest vegetation on the site will be retained and not disturbed thereby conserving potential refuge, forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This readily observed sedentary species refuges, forages and breeds mainly in drier woodlands with tussocks, fallen logs, branches and rocks (Pizzey & Knight, 2007). Found mainly in grassy ground layer of dry sclerophyll forests and woodlands, often with scattered shrubs in understorey, mainly on slopes of the Great Divide, rarely reported from the coast (Higgins & Peter, 2002).

50. *Xanthomyza Phrygia* Regent Honeyeater

Potential habitat for this species may be found on the study site. This species could potentially be an irregular and transitory visitor to the eucalypts, when in flower, on the study site from its preferred habitat west of the Great Divide. The species was not found on the study site during this survey. It will be recommended to retain areas of native vegetation on the site thereby retaining potential forage habitat for this species.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This migratory species prefers dry open forest and woodlands with a range of eucalypt species, especially ironbarks (Morcombe, 2000), but will also utilise farmland, streets and gardens (Pizzey, 1998). Found mainly on and west of the Great Divide in NSW with few recent records of the species on the coasts although the species will visit the coast, possibly in response to poor food supply in core breeding areas (Higgins *et al*, 2001).

52. *Melithreptus gularis gularis* Black-chinned Honeyeater

Potential habitat for this species may be found on the study site. This species may be an irregular and transitory visitor to the eucalypts, when in flower, on the study site from its preferred habitat west of the Great Divide. The species was not found on the study site during this survey. It will be recommended to retain and not disturb forest vegetation on the site thereby conserving potential habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This nomadic species prefers forest and woodland of eucalypts, paperbarks and tree lined watercourses of arid regions (Morcombe, 2000). This seasonally nomadic species prefers drier eucalypt forests and woodlands, timber on watercourses, often with no understorey, scrubs and Ironbark forests on the western slopes (Pizzey, 1998).

53. ***Pomatostomus temporalis temporalis*** **Grey-crowned Babbler**

Potential refuge, forage and breeding habitat for this species may be found on the study site. This species was not recorded on the study site during this survey. Much of the existing forest vegetation on the site will be retained and not disturbed thereby conserving potential refuge, forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This readily observed sedentary species is found in open forests, woodlands, scrublands, farmlands and outer suburbs (Pizzey & Knight, 2007). Found mainly in open forests and woodlands with an open shrub layer, sparse groundcover, fallen timber and leaf litter (Higgins & Peter, 2002).

54. ***Daphoenositta chrysoptera*** **Varied Sittella**

Potential refuge, forage and breeding habitat for this species may be found on the study site. This species was not recorded on the study site during this survey. Much of the existing forest vegetation on the site will be retained and not disturbed thereby conserving potential refuge, forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This readily observed species is found in open eucalypt forests and woodlands, mallee, inland acacia and coastal tea-tree scrubs (Pizzey & Knight, 2007). Found mainly in eucalypt forests and woodlands, usually with rough-barked trees such as stringybarks and ironbarks (Higgins & Peter, 2002).

55. ***Petroica boodang*** **Scarlet Robin**

Potential refuge, forage and breeding habitat for this species may be found on the study site. This species was not recorded on the study site during this survey. Much of the existing forest vegetation on the site will be retained and not disturbed thereby conserving potential refuge, forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This readily observed species is found in foothill forests, woodlands, watercourses and in autumn and winter more open habitats including golf courses, parks, gardens and orchards (Pizzey & Knight, 2007). Found mainly in eucalypt forests and woodlands with an open understorey, in autumn and winter may disperse to more open habitats including urban areas (Higgins & Peter, 2002).

56. ***Dasyurus maculatus*** **Spotted-tailed Quoll**

Potential forage habitat for this species may be found on the site. Prey species such as birds, reptiles and small mammals, including possums and rats are likely found on the site. The species was not recorded on the site during this survey. A portion of the existing vegetation on the site will be retained thereby conserving potential forage habitat for this species and its prey species on the site.

The life cycle of the species is unlikely to be disrupted such that a viable local population of the species would be placed at risk of extinction.

This nocturnal species prefers rainforest, open forest, woodland and coastal heathland (Strahan, 1998) and requires hollow logs, caves or rock crevices as shelter and breeding dens. The Spotted-tailed Quoll is an opportunistic carnivore that preys on birds, reptiles and small mammals, including gliders, possums and rats etc and also scavenges on carrion (NSW DECC Threatened Species profile).

57. *Phascogale tapoatafa* Brush-tailed Phascogale

Potentially suitable habitat for this species may be found on the study site. Hollows potentially suitable for this species are found on the site. Brush-tailed Phascogales were not recorded on the study site during this survey. Much of the existing forest vegetation on the site will not be disturbed by the proposed development thereby conserving potential refuge, forage and breeding habitat for this species on the site. However, considering the isolation of vegetation on the site from extensive areas of native vegetation then this species is unlikely to be found on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers open forest with sparse ground cover (Strahan, 1995) and dry sclerophyll forest and open woodlands that contain hollow bearing trees (Maxwell *et al*, 1996). The carnivorous and nocturnal Brush-tailed Phascogale forages, preferentially in rough barked trees, for prey such as spiders, centipedes, beetles and cockroaches plus nectar and occasionally small vertebrates (NSW DECC Threatened Species profile).

58. *Phascolarctos cinereus* Koala

Potential forage and refuge habitat for this species is found on the study site. Preferred koala feed trees are found on the site. However, no koalas or signs of koalas were observed on the site during this survey. There are only two (2) records in the Bionet wildlife database of koalas within 5km of the site. Much of the existing forest vegetation on the site including Koala feed trees, will not be disturbed by the proposed development thereby conserving potential habitat for this species on the site. However, considering the isolation of vegetation on the site from extensive areas of native vegetation then this species is unlikely to be found on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development on the site such that a viable local population of the species would be placed at risk of extinction.

This species has a widespread but patchy distribution in eastern NSW (Ellis & Etheridge, 1993) and is usually associated with eucalypt forests throughout the range with marked local and regional preferences for various eucalypt species as feed trees (Strahan, 1998). Koala home ranges can vary from male to female and depending on the palatability and nutritional value of the feed trees. They are generally from less than 2 to greater than 3 hectares but in areas of low preferred tree densities can be up to 100 hectares (Martin and Handasyde, 1999). Koalas are known to feed on a wide variety of eucalypt and other tree species however in Schedule 2 of SEPP No 44 is a list of ten "primary koala feed trees".

66. *Petaurus norfolkensis* Squirrel Glider

Potential forage, refuge, breeding and den habitat for this species is found on the site. Squirrel Gliders were recorded during trapping and spotlighting surveys on this site. Trees with potentially suitable hollows for this species as den or breeding habitat are found on the site and the site contains vegetation with mixed aged eucalypt trees with a range of species and understorey shrubs including wattles as forage habitat for this species. Much of the existing native forest vegetation on the site, including hollow bearing trees, will be retained thereby conserving forage, refuge and breeding habitat for this species on the site. Corridors of vegetation will be retained between the forest patches on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species prefers open forest or woodland with hollow bearing, mature or mixed aged stands with several eucalypt species (Murray, 1996). It inhabits dry sclerophyll forest and woodland and is absent from dense coastal ranges (Strahan, 1998). It forages in eucalypt trees and shrubs such as wattles primarily for insects (Menkhorst, 1995) but also sap, nectar and pollen and utilises old trees with hollows for den habitat (Strahan, 1998). This glider "is known to travel up to 1km from foraging areas to a preferred hollow" (Menkhorst, 1995).

61. *Pteropus poliocephalus* Grey-headed Flying-fox

Forage habitat for this species is found on the site. Grey-headed Flying-foxes were heard on nearby land during this survey. Grey-headed Flying-foxes are likely to forage in flowering eucalypt trees, especially Spotted Gums, when these trees are in flower on the site. The site does not support a daytime roost (camp) of this species. A portion of the existing forest vegetation on the site will be retained thereby conserving forage habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species feeds on the blossoms of a large range of eucalypt and non-eucalypt tree and shrub species; rainforest fruit species comprise a small proportion of the diet of flying-foxes in NSW (Eby, 1995). Grey-headed Flying-foxes roost in large numbers during the day in "camps" that have a history of irregular or permanent use over many years (Eby, 1995). This bat will fly over 30km from the camp to foraging areas (Menkhorst, 1995).

62. *Saccolaimus flaviventris* Yellow-bellied Sheathtailed-Bat

Forage habitat for this species may be found over the study site. Potentially suitable hollow bearing trees are found on the site for this species to breed and roost in. Open areas on the site are available for this species as forage habitat and forage habitat is available on farmland and wetland areas north of the site. This species was not recorded on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This widespread species forages for insects above the canopy and roosts in tree hollows (Strahan, 1998). Insectivorous bats are known to travel widely from roost trees to favoured forage areas.

63. *Mormopterus norfolkensis* Eastern Freetail Bat

Forage, roost and breeding habitat for this species is found on the site. This species was not recorded on the site during this survey. Some hollow bearing trees on the site could potentially be used by this species as roost and breeding habitat. Much of the existing forest vegetation on the site, including hollow bearing trees, will be retained thereby conserving forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species forages in dry eucalypt forest and woodland (Strahan, 1998). The species apparently roosts in tree hollows and forages in openings and gaps in the forest (Churchill, 1998). Very little is known about this species.

64. *Chalinolobus dwyeri* Large-eared Pied Bat

Forage habitat for this species may be found on the site. This species was not recorded on the site during this survey. There are no caves or mines on the site in which individuals or a population would roost or breed. Much of the existing vegetation on the site will be retained thereby conserving forage habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species forages in tall open eucalypt forest, dry sclerophyll forest, woodland, wet sclerophyll forest and rainforest and roosts predominantly in caves and mines (Churchill, 1998).

65. *Falsistrellus tasmaniensis* Eastern False Pipistrelle

Potential habitat for this species may be found on the site although the species is more common at higher elevations. Individuals or a population of the species may forage about the tree canopy of the study site or utilise the hollow bearing trees on the site for roosting or breeding. This species was not recorded on the site during this survey.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species inhabits sclerophyll forests, at cool elevations (Strahan, 1995). It forages within or just below the tree canopy, from the ranges to the coast and prefers wet habitats where trees are more than 20m high and generally roost in hollow trunks of eucalypt trees though they have been recorded in caves (Churchill, 1998).

66. *Miniopterus australis* Little Bent-wing Bat

Forage habitat for this species may be found on the site. This species was recorded on the site during this survey. There are no caves, mines or large culverts on the site in which individuals or a population would roost or breed.

Much of the existing forest vegetation on the site will be retained thereby conserving forage habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species forages, between the shrub and canopy layers, in tall open eucalypt forest, dry sclerophyll forest, woodland, wet sclerophyll forest, rainforest and melaleuca swamps and roosts and breeds in caves and mines (Churchill, 1998).

67. *Miniopterus schreibersii oceanensis* Large Bent-wing Bat

Forage habitat for this species may be found on the site. This species was recorded on the site during this survey, however, there are no caves or mines on the site in which individuals or a population would roost or breed. Much of the existing vegetation on the site will be retained thereby conserving forage habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This fast flying species forages, above the canopy layer, in tall open eucalypt forest, dry sclerophyll forest, woodland, wet sclerophyll forest, rainforest, melaleuca swamps and over grasslands and roosts and breeds in caves, mines and culverts (Churchill, 1998).

68. *Myotis macropus* Southern Myotis

Forage habitat for this species may be found in the study area. This species was recorded over ponds on the site during this survey. There are no caves, mines or large culverts on the study site in which individuals or a population would roost and breed. This species will forage over open water on ponds on the site and may roost in culverts of drains etc nearby or caves and mines in the local region. Some of the ponds with open water will likely be retained on the site, however, there are other open surface water ponds in the local area over which this species may forage.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species forages for insects over streams and pools in mangroves, paperbark swamps, rainforest, wet and dry sclerophyll forest and open woodland. The species roosts in caves but is also known to roost in tree hollows, vegetation, Pandanus, under bridges, in mines, tunnels and stormwater drains (Churchill, 1998).

69. *Scoteanax rueppellii* Greater Broad-nosed Bat

Forage, roost and breeding habitat for this species is found on the site. This species was recorded on the site during this survey. Some hollow bearing trees on the site could potentially be used by this species as roost and breeding habitat. Much of the existing forest vegetation on the site, including hollow bearing trees, will be retained thereby conserving forage and breeding habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This slow flying species forages within 20m of the ground along tree lines often adjacent to cleared paddocks and prefers moist gullies in mature coastal forest but also forages in gullies of dry sclerophyll forest, woodland, wet sclerophyll forest and roosts in hollow tree trunks and branches (Churchill, 1998).

46. *Vespadelus troughtoni* Eastern Cave Bat

Forage habitat for this species may be found on the study site. This species was not recorded on the site during this survey. There are no caves or mines on the study site in which individuals or a population would roost or breed. Much of the existing forest vegetation on the site will be retained thereby conserving forage habitat for this species on the site.

The life cycle of the species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

This species forages in tall open eucalypt forest, dry sclerophyll forest, woodland, wet sclerophyll forest and rainforest and roosts predominantly in caves and mines (Churchill, 1998).

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

No threatened flora or fauna species found within 10km of the study site are part of an "endangered population" cited in Schedule 1, Part 2 Endangered Populations of the TSC Act 1995.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(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,

The site does not support a "Critically Endangered Ecological Community" (CEEC) as listed under Schedule 1A, Part 2 of the TSC Act 1995.

According to vegetation mapping (LHCCREMS, 2003) and ground investigations the site does support an "Endangered Ecological Community" (EEC) identified under Part 3 of Schedule 1 of the TSC Act 1995.

The site supports two EEC's, these are identified as

- **Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion**
- **Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions**

Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion is found on the south-east and south-west corner portions and along much of the south edge of the site (**Fig-3**). Much of this EEC is in relatively good condition and will be conserved by the proposed development. Some already disturbed parts at the edges of this EEC may be cleared or partially cleared for an Asset Protection Zone. Of the approximately 13.6 hectares of SGIF on the site about 3.9 hectares (28.7%) of SGIF would be cleared or disturbed by the APZ (as indicated in a plan provided 30.9.14). Clearing of approximately 3.9 hectares of this EEC from the site is an insignificant portion of the Regional (26,917 hectare) and Local (1204 hectare) occurrence of this EEC as of 2000. As of 2000, according to the Maitland Greening Plan (MCC, 2002), approximately 1204 hectares (9.5%) of the local pre 1750 extent of this EEC remained. A recommendation in the Maitland Greening Plan suggests the Conservation outcome for this EEC should be "No Net Loss".

Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions is found either side of a shallow drainage depression in the centre north portion of the site (indicated as Red Gum Forest in **Fig-3**). Most of this EEC appears to have undergone some form of disturbance. Some heavily disturbed parts at the edges of this EEC may be cleared or partially cleared for an Asset Protection Zone. Much of the EEC will be retained by the proposed development. Most of the areas of this EEC to be cleared by the APZ are already

degraded or on disturbed land. The main core of this community on the site will be retained. Of the approximately 4.7 hectares of Red Gum Forest on the site about 2.0 hectares (42%) would be cleared or disturbed by the APZ (as indicated in a plan provided 30.9.14). Clearing of approximately 2.0 hectares of this EEC from the site is an insignificant portion of the Regional (4,856 hectare) and Local (670 hectare) occurrence of this EEC as of 2000. According to the Maitland Greening Plan (MCC, 2002), approximately 670 hectares (15%) of the local pre 1750 extent of this EEC remained as of 2000. A recommendation in the Maitland Greening Plan suggests the Conservation outcome for this EEC should be "No Net Loss".

The proposed development is unlikely to **have an adverse effect on the extent** of an ecological community such that its local occurrence is likely to be placed at risk of extinction.

The proposed development is unlikely to **substantially and adversely modify the composition** of an ecological community such that its local occurrence is likely to be placed at risk of extinction.

(d) in relation to the habitat of a threatened species, population or ecological community:

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

According to plans provided, the proposed development will retain about 80% of the Spotted Gum Ironbark Forest and about 60% of the Red Gum Forest (**Fig-3**) on the north, east and west portions of the site. About one third of the existing native forest vegetation on the site will be removed or modified as a result of the proposed action.

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

Connectivity will be retained between areas of retained native forest vegetation on the east and west portions of the site. There are no corridors to forest vegetation north of the site and only broken corridors to vegetation off the south of the site. Land surrounding the site is already heavily cleared and fragmented. An area of habitat is unlikely to become fragmented or isolated from other areas of habitat as a result of the proposed action

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

The relatively small area of forest vegetation proposed to be cleared for development on the site is unlikely to be significant or important to local threatened species, populations and ecological communities. However, it is here recognised that the cumulative impact of clearing many small areas of native vegetation over time is likely to be significant.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The site and adjacent areas are not "critical habitat" as described and listed in the Register of Critical Habitat kept by the Director General of the Department of Environment and Conservation.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There are few State or Federal recovery plans (draft or final) available for threatened species in the local region and none available for threatened insectivorous bats. For the following species that may be affected by the proposed development recovery plans are available –

- Grey-headed Flying-fox
- Koala
- Regent Honeyeater
- Large forest owls

Conserving much of the native vegetation on the site is likely to be consistent with the objectives of recovery plans for the above mentioned species.

Threat abatement plans are available for –

- Red Fox
- Bitou Bush
- Plague Minnow

These species were found or are already likely to be found on or near the site, however, the proposed development is unlikely to introduce or intentionally encourage these species into the area.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The following Key Threatening Processes are listed in Schedule 3 of the Threatened Species Conservation Act 1995.

I. **Alteration of habitat following subsidence due to longwall mining** – the proposed development is not longwall mining and will not cause alteration of habitat following subsidence due to longwall mining

II. **Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands** – the proposed development is unlikely to alter flow regimes of creeks, rivers and streams.

III. **Anthropogenic Climate Change** – clearing of a small area of vegetation from the site is unlikely to contribute significantly to anthropogenic climate change. However the cumulative impact of clearing many small areas may have a significant impact. It will be recommended to minimize clearing.

IV. **Bushrock removal** – It will be recommended to not disturb natural bushrock where not necessary and not to remove natural bushrock from the site.

V. **Clearing of native vegetation** - Loss of the small area of native vegetation from the site for the proposed development is unlikely to immediately threaten the survival or evolutionary development of species, populations or ecological communities or their habitats. However clearing of vegetation from the study site may contribute over time to the cumulative impact of native vegetation loss and fragmentation in the local area.

VI. **Competition and grazing by feral European Rabbit, *Oryctolagus cuniculus*** – the proposed development is unlikely to intentionally cause the introduction of feral rabbits into the local area. Feral rabbits are already found on the site.

VII. **Competition and habitat degradation by Feral Goats, *Capra hircus*** - the proposed development is unlikely to intentionally cause the introduction of feral Goats into the local area.

VIII. **Competition from feral honey bees, *Apis mellifera*** - the proposed development is unlikely to intentionally cause the release of feral honey bees into the local area.

IX. **Death or injury to marine species following capture in shark control programs on ocean beaches** – not applicable.

X. **Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments** – the proposed development is unlikely to release anthropogenic debris into the marine or estuarine environment.

XI. **Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners** – the proposed development is unlikely to intentionally encourage psyllids and Bell Miners onto the site.

XII. **Herbivory and environmental degradation caused by feral deer** - the proposed development is unlikely to intentionally encourage or release deer onto the site.

XIII. **High frequency fire** – the proposed development is unlikely to introduce a high fire regime to native vegetation in the local area.

XIV. **Importation of Red Imported Fire Ants *Solenopsis invicta*** – the proposed development is unlikely to intentionally or knowingly import Red Fire Ants into the local area

XV. **Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations** – the proposed development is unlikely to intentionally cause infection of psittacine (parrot) species in the local area with Psittacine Circoviral Disease.

XVI. **Infection of frogs by amphibian chytrid causing the disease chytridiomycosis** – the proposed development is unlikely to cause the intentional spread of chytridiomycosis.

XVII. **Infection of native plants by *Phytophthora cinnamomi*** - the proposed development is unlikely to intentionally cause infection of native plants by *Phytophthora cinnamomi* in the local area

XVIII. **Introduction of the Large Earth Bumblebee *Bombus terrestris*** – the proposed development is unlikely to intentionally cause the introduction of the Large Earth Bumblebee into the local environment.

XIX. **Invasion and establishment of Scotch Broom (*Cytisus scoparius*)** - the proposed development is unlikely to intentionally infect the site with Scotch Broom.

XX. **Invasion and establishment of Lantana (*Lantana camara*)** – the site already contains extensive patches of Lantana.

XXI. **Invasion and establishment of Cane Toad (*Bufo marinus*)** – these amphibians are not found on the site and the proposed development is unlikely to cause the introduction of Cane Toads to the site or local area.

XXII. **Exotic Vines and Scramblers** – A small number of exotic vines and scramblers are already found on the site. The proposed development will be encouraged to not use exotic plants in gardens and as landscaping for the site.

XXIII. **Invasion of native plant communities by African Olive (*Olea europaea*)** - the proposed development is unlikely to intentionally introduce African Olive to native vegetation on the site or the local area. This plant is already found on the site.

XXIV. **Invasion of native plant communities by *Chrysanthemoides monilifera*** - the proposed development is unlikely to intentionally introduce *C. monilifera* to native vegetation on the site or the local area. This plant is already found on the site.

XXV. **Invasion of native plant communities by exotic perennial grasses** – exotic perennial grasses are already present on the site, especially in disturbed areas of the site.

XXVI. **Invasion of the Yellow Crazy Ant, (*Anoplolepis gracilipes*) -** the proposed development is unlikely to intentionally introduce Yellow Crazy Ants to native vegetation on the site or the local area.

XXVII. **Loss of hollow bearing trees** – the proposed development will minimize the number of hollow bearing trees disturbed or removed.

XXVIII. **Loss or degradation (or both) of sites used for hill-topping by butterflies** – the proposed development is unlikely to destroy vegetation on higher ground that may be utilised by butterflies for hill-topping.

XXIX. **Predation and hybridisation by Feral Dogs, (*Canis lupus familiaris*)** – the proposed development is unlikely to intentionally cause predation and hybridisation by feral dogs.

XXX. **Predation by *Gambusia holbrooki* (Plague Minnow or Mosquito Fish) -** the Plague Minnow is already present in ponds on the site but is unlikely to be further encouraged or protected by the proposed development.

XXXI. **Predation by the European Red Fox *Vulpes Vulpes*** – the Fox is already present in the local area but is unlikely to be further encouraged or protected by the proposed development.

XXXII. **Predation by the Feral Cat *Felis catus* -** the Feral Cat is likely already present in the local area but is unlikely to be further encouraged or protected by the proposed development.

XXXIII. **Predation by the Ship Rat *Rattus rattus* on Lord Howe Island** – not applicable.

XXXIV. **Predation, habitat degradation, competition and disease transmission by Feral Pigs *Sus scrofa*** – The proposed development is unlikely to cause the introduction or spread of feral pigs into the local area.

XXXV. **Removal of dead wood and dead trees** – the proposed development is likely to cause the removal of some dead wood on the ground and small dead trees from that part of the site being developed.

APPENDIX – I Fauna trapping results

Trap site locations and transects are indicated in figures of this report.

Site - old brickworks site, Metford Road, Metford, NSW
Co-ordinates of site - (centre of site) 369551 E 6374532 N

M = Male **F** = Female

Note - For this survey, trapped fauna are released as soon as possible to reduce stress, unless handling is required for identification, therefore details such as sex and weight of individuals are often not recorded.

SGIF = Spotted Gum Ironbark Forest, RGF = Red Gum Forest, RA = Rehabilitation area.

Trap results

Date	Trap location	Trap type	Species captured	Sex	Wgt (g)	Comment
15.9.14	See Fig	Ell A				Set traps
"	See Fig	Ell B				Set traps
"	See Fig	Cage				
"	See Fig	Camera				
16.9.14		Ell A	Nothing			
"		Ell B	Nothing			
"		Cage	Nothing			
"		Camera	Nothing			
"	See Fig	Harp				Set trap
17.9.14	SGIF west	Ell A2	Black Rat			
"		Ell B	Nothing			
"		Cage	Nothing			
"		Camera	Nothing			
"	RGF	Harp	Lesser Long-eared Bat	F		
18.9.14	SGIF west	Ell A1	Black Rat			
"	SGIF west	Ell B2	Squirrel Glider			
"		Cage	Nothing			
"		Camera	nothing			
"	SGIF west	Harp	Goulds Wattled Bat	F		Harp traps pulled in
19.9.14	SGIF west	Ell A4	Black Rat			
"		Ell B	Nothing			
"	SGIF west	Cage	Black Rat			
"	RGF	Camera	Fox			
"						All traps pulled in

Camera trap results

Unit No	Date set	Date collected	Location	Species recorded
TC01	15.9.14	19.9.14	SGIF – west	Nothing
TC01	23.9.14	25.9.14	Rehabilitation area	Nothing
TC02	15.9.14	19.9.14	RGF - east	Fox
TC02	23.9.14	25.9.14	SGIF – south-west	Nothing
TC03	23.9.14	25.9.14	SGIF – east	Fox
TC04	23.9.14	25.9.14	RGF - west	Fox

Hair tube results

Date set	Date collected	Size & type	Location	Mammal ID – definite/probable
17.9.14	23.9.14	40mm arboreal	RGF east #1	Swamp Rat (*Rattus lutreolus*) - definite
17.9.14	23.9.14	40mm arboreal	RGF east #2	Swamp Rat (*Rattus lutreolus*) - definite
17.9.14	23.9.14	40mm arboreal	SGIF west #3	Swamp Rat (*Rattus lutreolus*) - definite

APPENDIX - J Bird Sample Plots

All birds heard or observed from the survey location were recorded.

Bird sample - Plot 1

Date - 11.9.14 **Time -** 0850-0910
Study area - old brickworks site Metford Rd, Metford
Co-ordinates - 369557E, 6374480N
Bird Plot location - centre of site in rehabilitation area
Habitat description - Rehabilitation area
Conditions - clear, light breeze, mild

Bird sample - Plot 2

Date - 11.9.14 **Time -** 1510-1530
Study area - old brickworks site Metford Rd, Metford
Co-ordinates - 369128E, 6374487N
Bird Plot location - south-west corner
Habitat description - Forest
Conditions - clear, light breeze, mild

Bird sample - Plot 3

Date - 12.9.14 **Time -** 1440-1500
Study area - old brickworks site Metford Rd, Metford
Co-ordinates - 370146E, 6374240N
Bird Plot location - south-east corner
Habitat description - Forest
Conditions - overcast, still, mild

Bird sample - Plot 4

Date - 16.9.14 **Time -** 0730-0750
Study area - old brickworks site Metford Rd, Metford
Co-ordinates - 369894E, 6374277N
Bird Plot location - south-east edge
Habitat description - Forest
Conditions - light cloud, still, warm

Bird sample - Plot 5

Date - 18.9.14 **Time -** 0820-0840
Study area - old brickworks site Metford Rd, Metford
Co-ordinates - 369868E, 6374493N
Bird Plot location - north-east edge
Habitat description - Red Gum Forest
Conditions - clear, light breeze, mild

Bird sample - Plot 6

Date - 19.9.14 **Time -** 0720-0740
Study area - old brickworks site Metford Rd, Metford
Co-ordinates - 369838E, 6374423N
Bird Plot location - centre east
Habitat description - Red Gum Forest
Conditions - light cloud, light breeze, mild

Bird sample - Plot 7

Date - 23.9.14 **Time -** 0810-0830
Study area - old brickworks site Metford Rd, Metford
Co-ordinates - 369617E, 6374394N
Bird Plot location - centre of rehabilitation area
Habitat description - rehabilitation area
Conditions - clear, still, warm

Bird sample - Plot 8

Date - 23.9.14 **Time -** 0840-0900
Study area - old brickworks site Metford Rd, Metford
Co-ordinates - 369133E, 6374396N
Bird Plot location - south-west corner
Habitat description - Forest
Conditions - clear, still, warm

Scientific Name	Common Name	BP 1	BP 2	BP 3	BP 4	BP 5	BP 6	BP 7	BP 8
Acanthiza lineata	Striated Thornbill		2	3	4	5		7	8
Acanthiza nana	Yellow Thornbill								8
Acanthorhynchus tenuirostris	Eastern Spinebill			3					
Acrocephalus stentoreus	Reed Warbler	1				5			
Anas superciliosa	Pacific Black Duck	1							
Colluricincla harmonica	Grey Shrike-thrush								8
Coracina novaehollandiae	Black-faced Cuckoo-shrike		2	3			6		
Corvus coronoides	Australian Raven				4	5	6	7	
Dicaeum hirundinaceum	Mistletoebird		2	3	4	5	6		8
Gymnorhina tibicen	Australian Magpie	1		3				7	
Hirundo neoxena	Welcome Swallow	1				5			
Lichenostomus chrysops	Yellow-faced Honeyeater		2	3	4	5	6	7	8
Malurus cyaneus	Superb Blue Wren	1	2					7	8
Malurus lamberti	Variegated Wren					5	6		
Manorina melanocephela	Noisy Miner		2	3					
Melithreptus brevirostris	Brown-headed Honeyeater		2	3	4	5	6		8
Myzomela sanguinolenta	Scarlet Honeyeater		2		4	5	6		
Neochmia temporalis	Red-browed Finch			3	4				
Oriolus sagittatus	Olive-backed Oriole					5			
Pachycephala pectoralis	Golden Whistler		2	3	4	5			8
Pachycephala rufiventris	Rufous Whistler	1	2		4	5	6		
Pardalotus punctatus	Spotted Pardalote	1	2	3	4	5	6		
Phalacrocorax melanoleucos	Little Pied Cormorant					5			
Rhipidura fuliginosa	Grey Fantail	1	2	3			6		
Sericornis frontalis	White-browed Scrubwren		2			5	6		
Taeniopygia bichenovii	Double-barred Finch							7	
Trichoglossus haematodus	Rainbow Lorikeet				4	5	6		8
Zosterops lateralis	Silvereye	1	2	3	4	5	6	7	8

APPENDIX – K SITE PHOTOGRAPHS

A View through Spotted Gum Ironbark Forest vegetation, south-east corner of site.

B View through Spotted Gum Ironbark Forest vegetation, south-west corner of site.

C View through Red Gum Forest vegetation in north centre portion of site.

D View northwards over rehabilitation area in centre of site.

E View over one of the man-made settling ponds in north centre of site.

F View over pond on drainage line across centre of site. Azolla, a water fern, here forms the reddish brown cover on the surface of the pond.

APPENDIX – L Koala Assessment

Site - old brickworks site on Metford Road, Metford, NSW, in Maitland City Council LGA.

Is the site in a LGA listed in Sch 1 of SEPP 44 - Yes

Step 1. Is the land "potential koala habitat"?

It must be assessed if the site is "potential koala habitat" in which "areas of native vegetation where the trees of types listed in Schedule 2 (of SEPP 44) constitute at least 15% of the total number of trees in the upper or lower strata of the tree component". If none of the tree species listed in Schedule 2 are present or if these species constitute less than 15% of the total number of trees present, no further provisions of the policy apply to the DA.

Are native tree species of types found in Sch 2 of SEPP 44 and listed below, found on the site.

•	*Eucalyptus tereticornis*	Forest red gum	- Yes
•	*Eucalyptus microcorys*	Tallowwood	- No
•	*Eucalyptus punctata*	Grey Gum	- Yes
•	*Eucalyptus viminalis*	Ribbon or manna gum	- No
•	*Eucalyptus camaldulensis*	River red gum	- No
•	*Eucalyptus haemastoma*	Broad leaved scribbly gum	- No
•	*Eucalyptus signata*	Scribbly gum	- No
•	*Eucalyptus albens*	White box	- No
•	*Eucalyptus populnea*	Bimble box or poplar box	- No
•	*Eucalyptus robusta*	Swamp mahogany	- No

No. of native trees in the study area - > 1,000
No. of Schedule 2 koala feed trees in the study area - > 150
Percentage (%) of Sch 2 koala feed trees in study area - > 15 %

Is the number of Sch. 2 koala feed trees greater than 15% - Yes
Is the study area "potential koala habitat" - Yes

Further provisions of the policy apply as the study area is potential koala habitat.

Step 2. Is the land "core koala habitat"?

If the site contains potential koala habitat then it must be determined if the site also contains "core koala habitat". Further investigations for the existence of core koala habitat in the study area would be made by searching below, on or in koala feed trees, and other trees, for scats, scratches and the presence of koalas. The "Spot Assessment Technique" (Phillips, 1995) would be used if koalas are found to be utilising the study site, to determine the extent and level of use of feed trees by koalas over the site.

"Core koala habitat" means an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population (SEPP 44, def'n.).

Were koalas observed on site during diurnal and nocturnal searches - No
Were female koalas with young observed on the site - No
Were trees with typical koala scratches observed on the site - No
Were koala scats found on the site beneath koala feed trees - No
Are there past records (ie NPWS database) of koalas on the site - No

Is the site **Core Koala Habitat** - No

No further provisions of the policy apply as the study area is not core koala habitat.

APPENDIX – M Hollow bearing tree data

The location of the following hollow bearing trees is indicated in **Fig-3 & 6** of this report.

Hollow bearing trees for this survey are valued according to factors such as –

High (H) - tall, large, live or dead tree supporting large to small hollows, plus cracks and fissures; suitable for large to small fauna, especially threatened species, such as Black Cockatoos, forest owls, Squirrel Gliders and insectivorous bats.

Medium (M) - live or dead tree supporting smaller hollows plus cracks and fissures etc; potentially suitable for common and threatened species such as Possums, Squirrel Gliders and insectivorous bats.

Low (L) - small, live or dead tree supporting only small hollows, cracks, fissures and loose bark; suitable for smaller common and threatened species such as Squirrel Gliders, insectivorous bats, frogs and reptiles.

Ht = height; dbh = diameter at breast height

No.	Easting	Northing	Species	Ht (m)	dbh (m)	Value	Comment
1	370009	6374324	Spotted Gum *Corymbia maculata*	12	0.5	M	Main stem and main branch hollows
2	370043	6374334	Dead	10	0.4	M	Main stem and main branch hollows
3	369996	6374254	Spotted Gum *Corymbia maculata*	15	0.6	M	Main stem and main branch hollows
4	369987	6374254	Spotted Gum *Corymbia maculata*	22	0.7	M	Main stem and main branch hollows
5	369975	6374232	Dead	20	0.6	L	Cracks, fissures and loose bark
6	369950	6374241	Spotted Gum *Corymbia maculata*	25	0.5	L	Main branch hollows
7	369821	6374257	Grey Gum *Eucalyptus punctata*	18	0.8	M	Main branch hollows
8	369796	6374258	Dead	6	0.6	M	Main branch hollows
9	369784	6374270	Dead	6	0.5	M	Main branch hollows
10	369783	6374301	Spotted Gum *Corymbia maculata*	28	0.6	M	Main stem and main branch hollows
11	369806	6374302	Dead	7	0.6	M	Main stem hollows, cracks, fissures & loose bark & exotic bees nest
12	369822	6374318	Spotted Gum *Corymbia maculata*	28	1.0	M	Main stem and main branch hollows

APPENDIX - N Threatened species co-ordinates

Site - old brickworks site, Metford Road, Metford, NSW

Map zone - 56

Approximate co-ordinate locations of threatened species recorded on the site

Species name	Common name	Easting	Northing
Glossopsitta pusilla	Little Lorikeet	369140	6374519
Petaurus norfolcensis	Squirrel Glider	369182	6374489
Pteropus poliocephalus	Grey-headed Flying-fox	370173	6374115
Miniopterus australis	Little Bentwing Bat	369958	6374436
Miniopterus schreibersii	Large Bentwing Bat	369678	6374492
Miniopterus schreibersii	Large Bentwing Bat	369773	6374583
Miniopterus schreibersii	Large Bentwing Bat	370079	6374238
Myotis macropus	Large-footed Myotis	369678	6374492
Scoteanax rueppellii	Greater Broadnosed Bat	369773	6374583
Scoteanax rueppellii	Greater Broadnosed Bat	370079	6374238

End of Report

Addendum to

FLORA AND FAUNA ASSESSMENT – GFF 14341

Over

the old brickworks site, including
Lot 1, DP 1197061; Lot 1, DP 1195590; Lot 401, DP 755237;
Lot 266, DP 755237; Lot 7314, DP 1162607
Metford Road
Metford, NSW

December 2014

Introduction

An initial flora and fauna assessment report (**GFF 14341**) was completed for the old brickworks site at Metford Road, Metford in October 2014. The report identified that additional survey work for a number of threatened plants and a threatened frog was required.

Some threatened plant species are easier to detect during certain months of the year when they are in flower (**Table-1**). Green and Golden Bell Frogs (*Litoria aurea*) are best surveyed during warm wet nights during the months of October to January. The additional surveys were conducted through suitable habitat across the site for the threatened species, on three separate occasions during months indicated in **Table-1**.

The results of this additional survey work are here presented as an addendum to that initial report.

Site Visit Record

Date	Time	Weather conditions	Activity
14.10.14 day	0800-1600	Overcast, still, warm, occasional showers	Threatened plant survey, Green and Gold Bell Frog survey, flora and fauna observations
14.10.14 night	1900-2200	Overcast, light breeze, mild	Green and Gold Bell Frog survey, bat call collection, flora and fauna observations
11.11.14 day	0800-1645	Overcast, light breeze, warm, showers	Threatened plant survey, Green and Gold Bell Frog survey, flora and fauna observations
11.11.12 night	2000-2230	Overcast, still, warm	Green and Gold Bell Frog survey, bat call collection, flora and fauna observations
9.12.14 day	0800-1630	Partial cloud, light breeze, warm-hot	Threatened plant survey, Green and Gold Bell Frog survey, flora and fauna observations
9.12.14 night	2000-2300	Overcast, still, warm	Green and Gold Bell Frog survey, bat call collection, flora and fauna observations

Methods

Survey for the threatened plants and Green and Gold Bell Frogs was conducted according to DEC (2004) survey guidelines during the months indicated in **Table-1**.

Table – 1 Proposed survey months (s) for threatened plants and frog. Coloured months show extent of flowering period for plants and survey period for the frog.

Scientific Name	Common Name	J	F	M	A	M	J	J	A	S	O	N	D
Cynanchum elegans	White-flowered Wax Plant										s	s	
Rutidosis heterogama	Heath Wrinklewort										s	s	
Tetratheca juncea	Black-eyed Susan										s	s	
Acacia bynoeana	Bynoe's Wattle										s	s	
Maundia triglochinoides												s	s
Callistemon linearifolius	Netted Bottle Brush										s	s	
Eucalyptus parramattensis	Parramatta Red Gum										s	s	
Syzygium paniculatum	Magenta Lilly Pilly											s	s
Persicaria elatior	Tall Knotweed										s	s	
Grevillea parviflora	Small-flower Grevillea										s	s	
Zannichellia palustris											s	s	
Litoria aurea	Green and Golden Bell Frog										s	s	s

Note, during threatened plant and frog survey across the site some additional plant and animal species were observed and recorded. Additional night survey for insectivorous bats was also conducted.

Threatened plants

Threatened plant searches were conducted by "parallel line technique" and by "random meander" (Cropper, 1993) through likely habitat on the site. For ease of survey, vegetation across the site was divided into manageable blocks delineated by fences, tracks, drainage lines or clearings etc. Each block is surveyed in turn.

Threatened frogs

Survey for Green and Golden Bell Frogs was conducted about potentially suitable habitat for this frog including the settling ponds and ponds associated with the drainage line across the centre of the site. Diurnal (day) survey for frogs was performed on each of three separate days by searching reeds and rushes in ponds and vegetation at the edge of ponds during still warm periods plus turning logs and rubbish etc in and near wet areas. Nocturnal (night) spotlight searches were conducted for over 2 hours on each of three nights using a 50 watt hand held spotlight powered by a portable 12 volt rechargeable battery or a suitable strong torch. Frog-call playback for Green and Golden Bell Frogs was performed over ponds on each of three separate nights. From time to time survey activities are interrupted by periods of still and quiet listening for frog calls.

Results

Threatened plants

Dates and results of surveys for threatened plants conducted across the site are as follows.

14.10.14 no threatened plants recorded on the site
11.11.14 no threatened plants recorded on the site
09.12.14 no threatened plants recorded on the site

Threatened frogs

Dates and results of surveys for threatened Green and Gold Bell Frogs conducted on the site are as follows.

14.10.14 no threatened Green and Gold Bell Frogs recorded on the site
11.11.14 no threatened Green and Gold Bell Frogs recorded on the site
09.12.14 no threatened Green and Gold Bell Frogs recorded on the site

Additional species
A number of non threatened plants and animals were observed and recorded during survey activities about the site, these are presented in **Appendices A & B** of this Addendum report.

Discussion
Field work for the initial survey of this site was conducted during September 2014. A list of 70 threatened species within 10km of the site (**App-G** of **GFF 14341**) was generated from the Bionet Wildlife database for consideration in the initial flora and fauna assessment (**GFF 14341**). For about 44 of these threatened species there was habitat or potential habitat on the site. Several threatened plants and a threatened frog with potential habitat on the site required "additional" survey during their flowering or breeding period (**Table-1** this report). Three additional diurnal and nocturnal surveys for these threatened species were conducted during October, November and December 2014.

The additional survey of potential habitat throughout the site for the threatened plants and Green and Gold Bell Frog did not find these threatened species on the site. Consequently, the results of the additional survey do not alter the findings and recommendations of the initial report (**GFF 14341**).

Findings of the Commonwealth EPBC Act matters (**App-F** of **GFF 14341**) remain unchanged. The proposed development is unlikely to have a significant impact on endangered species such as

Acacia bynoeana	Bynoe's Wattle	Vulnerable
Grevillea parviflora ssp *parviflora*	Small-flower Grevillea	Vulnerable
Persicaria elatior	Knotweed	Vulnerable
Rutidosis heterogama	Heath Wrinklewort	Vulnerable
Tetratheca juncea	Black-eyed Susan	Vulnerable
Litoria aurea	Green and Golden Bell Frog	Vulnerable

Findings of the Assessment of Significance, or Seven Part Test, addressing s5A EPA Act 1979 (**App-H** of **GFF 14341**) remain unchanged. The life cycle of the following threatened species is unlikely to be disrupted by the proposed development such that a viable local population of the species would be placed at risk of extinction.

Cynanchum elegans	White-flowered Wax Plant	E1
Rutidosis heterogama	Heath Wrinklewort	V
Tetratheca juncea	Black-eyed Susan	V
Acacia bynoeana	Bynoe's Wattle	E1
Maundia triglochinoides		V
Callistemon linearifolius	Netted Bottle Brush	V
Eucalyptus parramattensis ssp. decadens		V
Syzygium paniculatum	Magenta Lilly Pilly	E1
Persicaria elatior	Tall Knotweed	V
Grevillea parviflora ssp. parviflora	Small-flower Grevillea	V
Zannichellia palustris		E1
Litoria aurea	Green and Golden Bell Frog	E1

Additional common plants and animals observed and recorded during additional survey activities about the site (**Appendices A & B** this report) also do not alter the findings and recommendations of the initial report (**GFF 14341**).

Conclusion

The proposed development, with the adoption of mitigating measures (**5.1** of **GFF 14341**), is unlikely to have a significant impact on the above mentioned threatened species.

References

Cropper, S.C., (1993), *Management of Endangered Plants*, CSIRO Publications, Melbourne.

DEC, (2004), *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities, (Working Draft)*, Department of Environment and Conservation (NSW)

APPENDIX - A Flora species list (Addendum)

Plant species on this list were recorded on the site during additional survey.

Classification follows that of Flora of New South Wales, Vols 1-4, (Harden, 1990-93).

# = Threatened Species
ssp. = Subspecies, var. = Variety, * = Introduced.
r = Regionally Significant Plant Species
n = Noxious weed plant in LGA.

Scientific Name	Common Name
FILICOPSIDA (Ferns)	
BLECHNACEAE	
Doodia aspera	Rasp Fern
MAGNOLIOPSIDA (Flowering Plants)	
Magnoliidae (Dicotyledons)	
APOCYNACEAE	
*Nerium oleander**	Oleander
EUPHORBIACEAE	
*Euphorbia peplus**	Petty Spurge
FABOIDEAE	
Indigofera australis	
Jacksonia scoparia	Dogwood
RUBIACEAE	
*Galium aparine**	Cleavers
Opercularia diphylla	Stinkweed
SCROPHULARIACEAE	
*Verbascum virgatum**	Twiggy Mullein
STACKHOUSIACEAE	
Stackhousia viminea	
Liliidae (Monocotyledons)	
COMMELINACEAE	
Commelina cyanea	Scurvy Weed
IRIDACEAE	
*Homeria miniata**	Two-leaved Cape Tulip

APPENDIX - B Fauna species list (Addendum)

Fauna species on this list were recorded during additional survey of the site

? = Unconfirmed
= Threatened Species

Scientific Name	Common Name
MAMMALS	
PSEUDOCHEIRIDAE	
Pseudocheirus peregrinus	Common Ringtail Possum
BIRDS	
RALLIDAE	
Gallinula tenebrosa	Dusky Moorhen
CHARADRIIDAE	
Elseyornis melanops	Black-fronted Dotterel
CUCULIDAE	
Eudynamys scolopacea	Common Koel
CINCLOSOMATIDAE	
Psophodes olivaceus	Eastern Whipbird
DICRURIDAE	
Myiagra rubecula	Leaden Flycatcher
HIRUNDINIDAE	
Hirundo ariel	Fairy Martin
REPTILES	
CHELUIDAE	
Chelodina longicollis	Long-necked Turtle
SCINCIDAE	
Eulamprus tenuis	Yellow-bellied Skink
FROGS	
HYLIDAE	
Litoria tyleri	Tyler's Tree Frog

Appendix B

Review (Forest Fauna Surveys, 2018)

New Maitland Hospital
Metford Rd, Metford

Peer Review of Biodiversity Assessment Report

Report to

pitt&sherry

2 May2018

Forest Fauna Surveys Pty Ltd

New Maitland Hospital
Metford Rd, Metford

Peer Review of Biodiversity Assessment Report

Report to

pitt&sherry

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EXECUTIVE SUMMARY

This peer review was prepared to assess the adequacy of previous ecological investigations of the New Maitland Hospital site off Metford Road, Metford. The initial fauna survey was constrained in detection of fauna species due to being conducted mid-winter (August). However, surveys in 2014 were conducted to account for seasonal and cryptic fauna species, resulting in collation of a comprehensive dataset. No further fauna surveys are considered necessary in order to adequately assess the impact of the proposed development on threatened fauna.

The proposed action will result in the clearing of remnant forest, either for the building footprint or maintenance of an Asset Protection Zone (APZ). One threatened fauna species, the Squirrel Glider, was recorded within the development impact area, and one bird species (Little Lorikeet) and several microbat species are likely to forage within the remnant forest or adjacent open space. The species considered most likely to be impacted is the Squirrel Glider.

There was inconsistency in the mapping of habitat trees by previous ecological surveys, with 2 habitat trees mapped within the development / APZ area, also referred to as Area of Influence. An additional survey in April 2018 was conducted to review the mapping. Three habitat trees with hollows were identified within the Area of Influence. Each tree was assessed as potentially suitable for either the Squirrel Glider or tree roosting threatened microbats, based on the presence of tree hollows. Within the Area of Influence, thinning of trees is recommended for an asset protection zone (APZ). Subject to no loss of these habitat trees, the proposed action would not to impact upon the viability of any threatened species identified in the subject site or Metford Triangle. However, installation of species specific nest boxes is recommended should habitat trees in the Area of Influence require clearing.

The review of previous ecological assessments did not discuss in detail the significance of the subject site / Metford Triangle to the local population of Squirrel Glider. This species may be impacted by actions such as clearing of habitat trees and fragmentation of habitat. The report by pitt&sherry (2018) identified an area of infill planting, to improve connectivity of habitat between remnant forest on the subject site and larger Metford Triangle. However, no detailed assessment was conducted of the viability of that population, and what measures may assist in improving longer term conservation outcomes for the Metford Triangle population.

This review mapped and ground validated the size and inter-connectiveness of all habitat patches suitable for the Squirrel Glider in local area. This analysis is required at a strategic level (i.e. local Council) to assist in planning and management of threatened species in the subject site and wider LGA. Most forested remnants (or habitat patches) suitable for the Squirrel Glider in the wider local area, are fragmented by gap clearings and are small in size. However, corridor connectivity between patches is not considered to be isolating in some instances, such that movements of gliders between patches is possible.

It is considered possible that movement of gliders between the subject site / Metford Triangle, and the nearest larger habitat patch, may occur, suggesting persistence in the short to medium term (20 – 50 years). Habitat enhancement measures, such as supplementary plantings of the site and local vegetation corridors, may improve the connectivity, and hence, viability of this local population.

Within the subject site and Metford Triangle, threatening processes that may impact upon this population include the presence of barbed-wire on the perimeter fencing. Where this fencing intersects with forested habitat, fauna species that either fly or glide are at risk of entanglement with the wire. It is recommended that

any future fencing preclude the use of barbed-wire where fencing intersects bushland. Ideally, all existing barbed-wire fencing within the Metford Triangle that intersects bushland should also be removed, though it is understood this may be outside the control of Health Infrastructure.

It is considered by this review that no further survey work is required to address the assessment on impact on threatened species. As a result of this peer review and the additional surveys and assessment undertaken by the author, the findings and conclusions of the Biodiversity Assessment Report prepared by pitt&sherry are supported. The proposed hospital would not have a significant impact on threatened species. Recommendations are provided to help minimise potential impacts on threatened fauna.

1.0 INTRODUCTION

Health Infrastructure commissioned consultancy company pitt&sherry to prepare a Biodiversity Assessment Report (BAR) to accompany an Environmental Impact Statement (EIS) for the New Maitland Hospital project. The BAR report by pitt&sherry consolidates a number of previous ecological investigations on the site for the new hospital, which was previously a quarry and brickworks site. Additional ecological investigations were also undertaken by pitt&sherry (2018) in relation to biodiversity offsetting.

Forest Fauna Surveys Pty Ltd was commissioned by pitt&sherry to undertake a detailed peer review of the previous ecological assessment work, and also identify any gaps specific to the threatened Squirrel Glider *Petaurus norfolcensis*, which was detected on site. The Squirrel Glider is listed as vulnerable on the NSW *Biodiversity Conservation Act 2016.*

1.1 Site Description

The location of the New Maitland Hospital is located off Metford Road, Metford, in Maitland City LGA. The site [Lot 7314 and part Lot 401 DP 755237] covers an area of 19.0 hectares, and was part of the larger PGH / CSR brickworks land, referred to as the Metford Triangle (pitt&sherry, 2018). The proposal for the New Maitland Hospital will see the construction of a new building and associated infrastructure located in Lot 7314 and part Lot 401, adjacent to Metford Road (refer to **Figure 1** below). The works will require the clearing of 2.45 hectares of forested vegetation within an area referred to as Project Influence Area for the building footprint and associated works, and also an asset protection zone (pitt&sherry, 2018).

A detailed description of the vegetation communities and the site is presented in previous ecological assessments (pitt&sherry, 2018; General Flora and Fauna, 2014; GHD, 2013). Four vegetation communities are described for the larger Metford Triangle, including:

- Lower Hunter Spotted Gum-Ironbark Forest,
- Hunter Lowland Redgum Forest,
- Acacia regrowth / Rehabilitation Plantings over disturbed land, and
- Artificial wetlands (GHD, 2013; General Flora and Fauna 2014).

The ecological assessments have identified a number of threatened fauna on the site and larger Metford Triangle, including 1 bird species (Little Lorikeet) and 6 mammal species (Squirrel Glider, Little Bentwing-bat, Eastern Bentwing-bat, Greater Broad-nosed Bat, Large-footed Myotis, Grey-headed Flying-fox). The Squirrel Glider and Little Lorikeet were recorded within the subject site, with the remaining threatened fauna recorded in the south-eastern corner of the Metford Triangle.

The assessment by General Flora and Fauna (2014) located 12 habitat trees in the south-eastern corner of the Metford Triangle (outside of the subject site), whilst pitt&sherry (2018) located 5 habitat trees within the subject site. The 2014 assessment did not locate any habitat trees within the subject site (including the area of influence).

1.2 Scope of this Review

This review has been prepared to assess the previous ecological assessment works of GHD (2013), General Flora and Fauna (2014) and pitt&sherry (2018). The basis of the review is to consider the adequacy of previous assessments specific to threatened fauna, and whether the proposed action will impact upon threatened fauna. A particular focus was a local population of the threatened Squirrel Glider, which was recorded on the subject site. This report also provides recommendations to assist with conservation of this threatened species in the larger locality to the subject site.

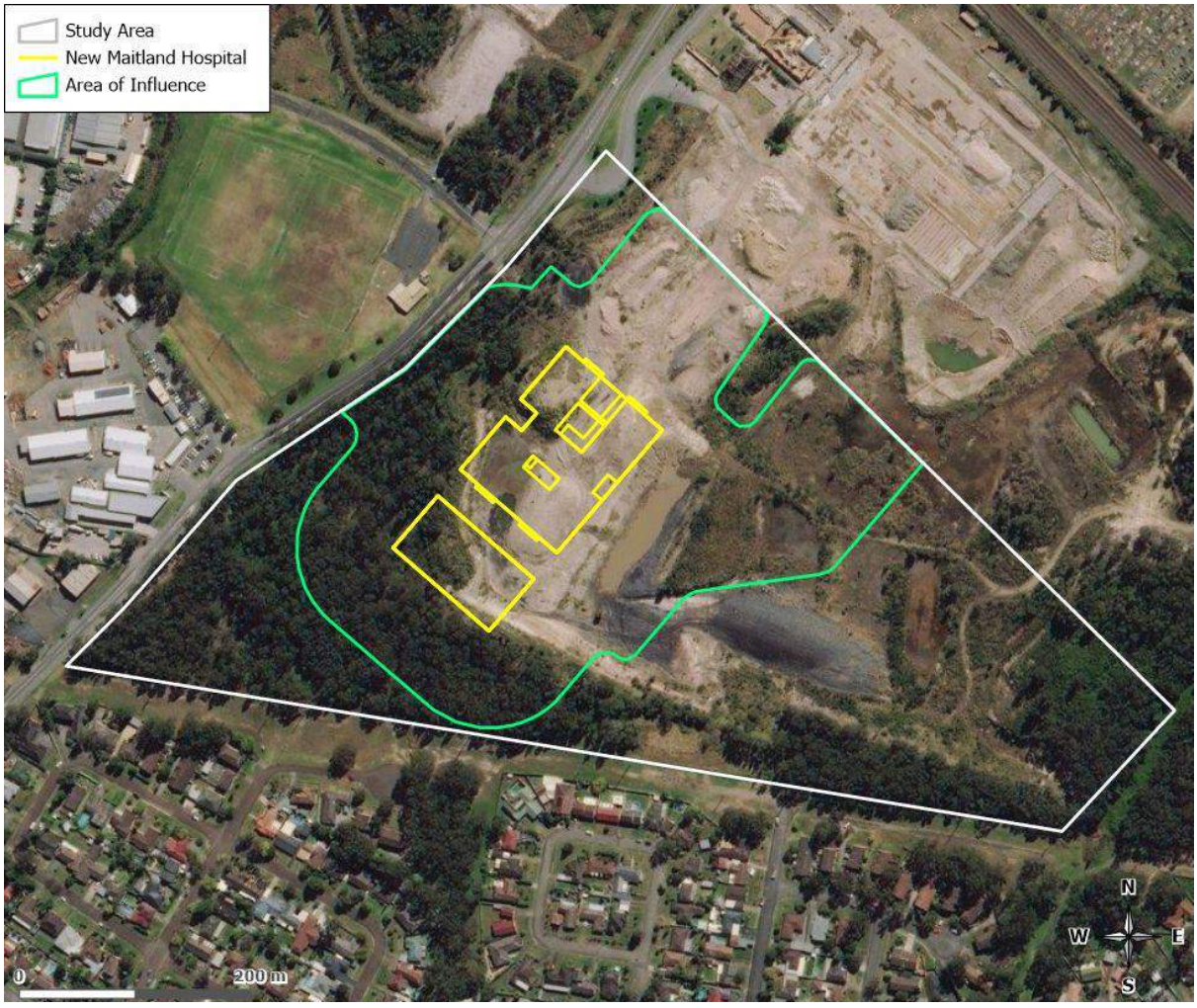

Figure 1. Lot 7314, New Maitland Hospital location, Metford Rd, Metford

2.0 METHODOLOGY

2.1 Review of Existing Literature

A review of ecological assessments prepared for the subject site were reviewed. Those reports include the following:

GHD (2013). *APP Corporation, Metford Quarry and Brickworks Site, Flora and Fauna Assessment.* Report by GHD, September 2013.

General Flora and Fauna (2014a). *Flora and Fauna Assessment, "the old brickworks site", Metford Road, Metford.* Report to Health Infrastructure (NSW Government). October 2014.

General Flora and Fauna (2014b). *Addendum to Flora and Fauna Assessment, GFF 14341 Over the old brickworks site, Lot 1 DP 1197061; Lot 1 DP1195590; Lot 401 DP 755237; Lot 266 DP 755237; Lot 731 DP 1162607, Metford Road, Metford.* Report to Health Infrastructure (NSW Government). December 2014.

pitt&sherry (2018). *Biodiversity Assessment Report, The New Maitland Hospital, Metford, NSW*. Report to NSW Health Infrastructure by KMH Environmental and pitt&sherry, March 2018.

Records of threatened fauna, particularly the Squirrel Glider, were obtained from the BioNet database, Office of Environment and Heritage on 15 April 2018.

Reports relevant to the threatened Squirrel Glider include the *Lake Macquarie Squirrel Glider Planning and Management Guidelines, 2015* and *Squirrel Glider (Petaurus norfolcensis) Conservation Management Plan: Wyong Shire.* (Smith, 2002).

2.2 Site Assessment

This site assessment undertook 2 tasks;

- foot traverse of the Area of Influence to inspect habitat values of the remnant forest for threatened fauna, and
- field survey and gap analysis to quantify fragmentation of remnant forested patches within the subject site, larger Metford Triangle and all adjoining remnants.

2.2.1 Habitat Features

Habitat features were located by walking the boundary of the subject site searching for mature trees with hollows and other features such as water bodies for frogs. The following data was recorded for each habitat tree:

- Tree species,
- Location recorded as easting and northing in GDA94 projection,
- diameter at breast height (dbh) (cm),
- height of tree (metres),
- % dead,
- number of major and minor limb spouts or hollows, number of trunk hollows or spouts, and
- assessment of likely fauna species to utilise hollows.

The assessment of likely fauna to utilise hollows was based on a size class of each hollow, where the following rating applied:

- Hollows with small openings <20mm or small fissures on dead branches, main trunk or split bark were classed as potential hollows for microchiropteran bats and small reptiles,
- Hollows with small openings >20mm <50 mm were classed as potential hollows for gliders and small birds (i.e. Squirrel Glider, Rainbow Lorikeet),
- Hollows with medium sized openings >50mm <150mm were classed as potential hollows for possums and larger birds (i.e. Eastern Rosella)
- Hollows with large openings >150mm diameter were classed as potential hollows for large birds such as owls, cockatoos and ducks, and reptiles such as Lace Monitor and Diamond Python.

2.2.2 Habitat Patch Analysis

Habitat analysis refers to the mapping of all forested habitat fragments (hereafter referred to as *patches*) which provide habitat for the threatened Squirrel Glider. Initially, all forested patches adjoining the subject site (and Metford Triangle) were identified from GIS analysis of recent aerial photographs. All stands of remnant forest were mapped as a continuous polygon, providing there was no gap greater than 30m. Gaps greater than 30m were mapped as a separate GIS polygon, or forest patch. Recent records of Squirrel Glider in the locality were overlayed on the patches to analyse the spatial distribution of the local population in relation to the subject site.

Ground truthing of mapped forest patches was undertaken. The patches were assessed for habitat condition, height of canopy and estimate of forest age. Gaps between adjoining patches were inspected and measured using Laser range finder (Bushnell Yardage Pro), accurate to 1.0 metre. Gap widths were measured recording distance from opposite tree trunks at 1.5m height. Potential obstacles to gliders within the gaps (i.e. powerlines, barbed-wire fencing) recorded the height(s) and width of obstacles.

At each gap location visited, a waypoint was recorded using hand held GPS (Garmin 60Csx) and photograph recorded. Waypoints were downloaded to Manifold GIS and overlayed on recent aerial photographs for validation.

3.0 RESULTS

3.1 Review of Existing Literature

Two previous fauna surveys have been conducted on the subject site and the larger Metford Triangle. The initial fauna survey was undertaken in August 2013 over 2 nights (GHD, 2013). Timing for this survey is not ideal to record the diverse group of fauna species likely to utilise habitats on the subject site. For instance, microbats, reptiles and some frog species may be dormant at this time of year if conditions are cold. Section 2.2.4 of the GHD (2013) acknowledges the limitations of seasonality in the detection of fauna species, indicating that the survey was not designed to detect all species present at the site. No details such as weather conditions is presented in the GHD (2013) to assess the nocturnal temperatures and likely influence on fauna activity.

A total of 45 native fauna and 2 introduced species were detected by the survey, including 31 birds, no reptiles, 2 frogs and a number of microbat species. Two habitat trees were located within the current subject site, although the methodology by GHD (2013) restricted the searches to trees >100cm dbh. This approach will fail to detect habitat trees with smaller dbh that contain tree hollows. No raw data of habitat trees is presented in the report for subsequent analysis, i.e. tree species description, location coordinates, tree hollow description, etc.

The second fauna survey was conducted over several days and nights from 9 to 24 September 2014 (General Flora and Fauna, 2014a). This survey is more comprehensive in survey effort and duration, resulting in the detection of 73 bird species, 24 mammals, 6 reptiles and 8 frog species. Additional targeted surveys for the endangered Green & Golden Bell Frog *Litoria aurea* were conducted over 3 nights in October, November and December 2014. No evidence of the species was detected in these surveys, despite being optimal weather conditions for detection (General Flora and Fauna, 2014b).

Habitat tree mapping was conducted across the Metford Triangle and recorded 12 trees, all of which are located in the south-eastern corner of the Triangle. No trees were mapped for the south-western corner, which includes the subject site. Location coordinates and tree species descriptions is presented in Appendix M of the General Flora and Fauna report. The two habitat trees located by GHD (2013) in the subject site, were not included in the General Flora and Fauna report. In summary, the fauna survey conducted by General Flora and Fauna (2014) is comprehensive in survey effort for the subject site.

The additional habitat assessment by pitt&sherry (2018) is a consolidation of the existing data collated by both GHD (2013) and General Flora and Fauna (2014a, 2014b). It is considered by this review that no further survey work is required to address the assessment on impact on threatened species.

3.2 Site Assessment

The site assessment for this report is therefore restricted to the Area of Influence for the proposed New Maitland Hospital. A diurnal site visit was undertaken on 12 April 2018. The area encompassed within the Area of Influence was searched on foot recording the presence of any significant habitat features, particularly for the threatened Squirrel Glider. Any dams or significant water bodies were also assessed for suitability for the endangered Green & Golden Bell Frog.

3.2.1 Habitat Features

Within the Area of Influence, three habitat trees were located. A description and location of each tree is presented below in **Table 1**, and their location mapped in **Figure 2**.

Table 1. Habitat Tree description, New Maitland Hospital

Tree ID	Tree Species	DBH(cm)	Height (m)	% dead	Hollow Description	Suitablility
HT_01	Spotted Gum	80	16	20	2 small branch	Glider
				Location	369169.07 E	6374455.48 N
HT_02	Spotted Gum	80	16	20	2 small trunk	Glider
				Location	369148.22 E	6374390.69 N
HT_03	Grey Gum	70	16	10	2 small branch	Glider / microbat
				Location	369199.22	6374383.67 N

All three trees contain only small sized hollows with less than 30mm openings, making them suitable for smaller arboreal vertebrates such as gliders, microbats, reptiles and frogs.

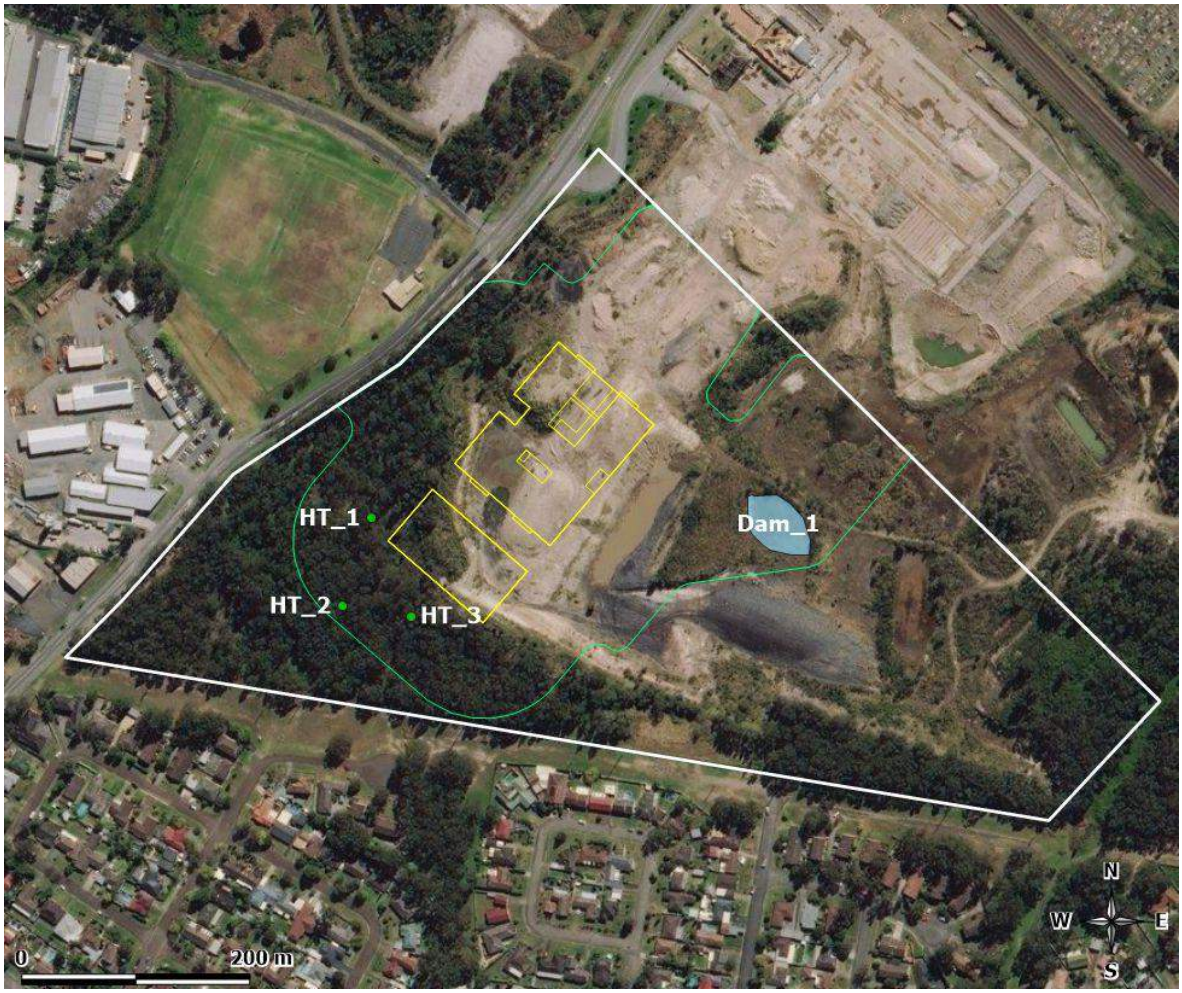

Figure 2. Habitat features, New Maitland Hospital location, Metford Rd, Metford

Habitat trees HT_02 and HT_03 appear to be in similar location to the two trees mapped in Figure 3-4 of the GHD (2013) report. However, there is no raw data in the GHD (2013) report to enable direct comparisons of tree species and or location coordinates. Pitt&Sherry also mapped 5 habitat trees within the study area (refer to Figure 8, p.32). All 5 trees occur outside of the area of influence for the project. Two trees are located along Metford Road, and three habitat trees are mapped along the southern boundary of the subject site. None of these habitat trees would be impacted by the proposed New Maitland Hospital works.

One water body was located within the Area of Influence. Dam_1 is a small ephemeral body measuring 30 x 30m (approx.) which supports a number of emergent aquatic plants, including *Typha orientalis* and *Juncus sp.* Around the fringes of the dam is dense growth of Couch Grass *Cynodon dactylon*. Water depth was approximately 0.2 – 0.3 m depth. Despite the presence of emergent aquatic plants, this dam is unsuitable for the Green & Golden Bell Frog due to the ephemeral nature of this body. Whilst standing water was present at the time of fieldwork, this body would dry quickly following periods of low rainfall.

3.2.2 Habitat Patch Analysis

A total of 34 habitat patches were assessed by either ground validation or GIS analysis to determine connectivity and size of habitat within the local Squirrel Glider population. A summary table of the habitat patch size is presented in **Table 2**, and also mapped in **Figure 3**.

Table 2. Habitat Patch Analysis

Patch ID	Area (ha)	Location	Viability Assessment
P1 - P2	8,17 (25)	Subject site and Metford Triangle	Low viability, good habitat, some infill planting needed, barbed wire fencing potential to impact local population
P3 - P5	2,2,1 (5)	North of Metford Triangle	Low viability, small remnants, highly fragmented
P6 - P8	4,7,1 (12)	NE of Metford Triangle	Low viability, small remnants, fragmented by railway and road
P9 – P11, P21	6,1,1 (8) (3)	Thornton suburb	Low viability, small fragmented patches, connectivity okay, infill planting required to improve corridor
P12 – P15	10,2,5,2 (19)	Thornton suburb	Very low viability, narrow linear fragmented patches, connectivity okay, very limited potential for improvement in habitat / corridor function.
P16 – P20	1,5,1,26,12 (45)	Green Hills	Low viability, several small fragmented patches, connectivity okay, number of recent glider records (2016), potential for connectivity to larger population off Mt. Vincent Road
P22 – P23	6,170 (176)	Thornton Industrial Park	Medium viability, Patch 22 isolated, Patch 23 high quality, large area, known historical glider population, potentially acts as large source population for subject site and Metford Triangle
P24 – P25,	101, 231 (332)	Thornton, Chisholm	Medium viability, Chisholm patches large in area, despite disturbance from clearing, known glider population. Thornton patch ~100ha, good quality habitat, some fragmentation and clearing within patch
P31 – P33	12,2,6 (20)	Thornton – Chisholm	Low viability, smaller patches fragmented although connectivity okay
P34	>1,800	Four Mile Creek	Significant local habitat patch, separated from Thornton Industrial patch by New England Highway (gap crossing 50m), high traffic volumes.

Figure 3. Local distribution of Habitat patches to subject site, Metford Rd, Metford

The subject site is located within a small habitat patch approximately 25 hectares in area (part of the Metford Triangle). Habitat linking to this small patch comprise a mosaic of equally small to very small habitat patches, separated by varying gap widths due to roadways, powerline easements, clearings for parklands, housing and the Main Northern Railway. The degree of fragmentation of habitat is very high within this context, with the nearest habitat patch >100 ha more than 1,800 metres to the east (Thornton Industrial patch). It is considered the most viable connection corridor between the subject site / Metford Triangle and nearest large habitat patch is to the east – south-east (refer to **Figure 4** below). Corridor linkage to the west and south is considered less viable due to absence of habitat and large cleared gaps in tree cover.

Figure 4. Habitat Patch linkage, Subject site to adjoining remnants, Metford Rd, Metford

The subject site / Metford Triangle Squirrel Glider population is considered a "sink" population, whereby individuals are continually lost (or drained) by natural and other factors (i.e. predation, injury). Recruitment of new individuals to this population, or "source" population, is likely to occur within the Thornton Industrial patch, despite tenuous connectivity between both habitat patches.

Within the wider locality, another "source" population is likely to exist within a large habitat patch south of Green Hills, but linkage between this population and the subject site / Metford Triangle is unlikely due to large cleared gaps (New England Highway, residential estates, clearing of habitat for expansion of nearby shopping centre).

Occupation rates of Squirrel Glider in habitat is strongly influenced by the size of the patches, degree of connectivity and habitat quality. Populations decline in abundance and density when patches fall below 100ha. Patches between 4 – 30 ha are considered at high risk of localised extinction, whilst patches 30 – 100ha at moderate risk, and >100ha at low risk in the short term (50 – 100 years)(Smith, 2002; LMCC, 2015). A remnant patch of habitat would need to exceed 400 hectares in area to ensure longer term survival of a viable local population (Goldingay *et al,* 2006).

Squirrel Gliders can move up to 1.0 km per night, with the longest recorded movement 1.9km (Sharpe & Goldingay, 2007). Gliders are reluctant to travel along the ground to cross open gaps in tree canopy, with gaps

>35m considered a potential barrier to crossing. For a Squirrel Glider to cross an open gap of 20m (such as a 2 lane roadway) in a single glide, a minimum tree height of 13m is required (Goldingay and Taylor, 2009), whilst a road canopy gap of 50m appears to be a complete barrier to glide crossings (van der Ree *et. al.,* 2010).

Despite the high degree of fragmentation in the Metford area, there is a number of recent records (since 2014) of the Squirrel Glider within the immediate area of the Metford Triangle. This would suggest that despite the high number of small fragments within proximity to the Metford Triangle, connectivity is sufficient between some remnants to either support a small population, or enable movement of individuals between patches.

The subject site comprises a small habitat patch approximately 8.0 hectares in area, which is separated from an adjoining forested patch in the Metford Triangle (16.8 ha) by a gap measuring 35m wide. However, within this gap there is 2 trees that would enable a glider to safely cross this gap without moving along the ground. The biodiversity assessment by pitt&sherry (2018) recommends infill planting of this area to improve habitat connectivity between the subject site and adjoining habitat patches (refer to Figure 11 – Supplementary Planting Location, pitt&sherry, p. 49). However, this review considers it unnecessary for installation of any glider poles to assist in movements across this gap. The significance of the larger 16.8 ha forest patch east of the subject site is the higher density of habitat trees in this remnant, and connectivity to adjoining habitat patches.

Beyond the subject site and Metford Triangle, the patches are small in area and highly fragmented. Movement of gliders to the south of the Metford Triangle is unlikely due to the very small size of the habitat patches (1.3 ha each), and obstacles such as electricity powerline easement (35m width) and perimeter barbed wire fencing. However, tree height on either side of the powerline easement is approximately 20m, enabling glides across this gap if required.

To the south-east of the Metford Triangle is a network of small habitat patches, which create a tenuous linkage to a large patch associated with the Thornton Industrial Park. This large remnant is about 170 ha in area and supports high quality habitat for the Squirrel Glider. The species has previously been trapped within this remnant (M. Murray, personal record). Due to the large size of this remnant patch, it is likely to support a viable local population in the shorter term (20 – 50 years).

Two gaps occur between the Thornton Industrial and Chisholm patch, the Main Northern Railway (47m) and Raymond Terrace Road (25m). Whilst the Main Northern Railway presents a large gap for gliders to cross, it has very limited additional barriers such as fencing and overhead powerlines. The railway does not have a high number of high speed rail movements, reducing the potential for gliders to collide with moving trains. Tree height at potential crossing points (25m) would enable single glides of up to 45 metres (glide angle = tree height x 1.8). This suggests the Main Northern Railway gap is not too wide to enable glider movements. The gap width of Raymond Terrace Road is only 25m, with trees to 15 – 20m tall at some potential crossing points. This road carries high traffic volumes, with increased risk of collisions between gliders and motor vehicles, particularly trucks.

The Thornton Industrial patch is separated from the Four Mile Creek habitat patch by the New England Highway. The Four Mile Creek patch is the most significant patch in the LGA for the Squirrel Glider and other threatened and protected fauna. The cleared gap of the highway is 55 metres at the narrowest point, with potential for glider crossings. However, this gap has very high traffic movements, particularly large trucks at night, which is likely to impact on glider crossings. It is therefore considered the New England Highway acts as a significant barrier to glider movements between subpopulations. Hence, the Thornton Industrial subpopulation has high significance to the subject site / Metford Triangle Squirrel Glider population. The longer term viability of the

subject site / Metford Triangle Squirrel Glider population is dependent upon connectivity between these two patches.

4.0 DISCUSSION

The previous ecological investigations on the subject site and larger Metford Triangle has resulted in collation of an extensive dataset of fauna species likely to occur within forested remnants. The initial fauna survey was constrained in the diversity of species detected, due to timing of the survey being conducted in mid-winter (August). However, a follow-up survey conducted in September to December 2014 was conducted to account for seasonal and cryptic fauna species. Further work by pitt&sherry addressed the requirements of biobanking and vegetation mapping, such that a comprehensive dataset has been collated for the subject site and larger Metford Triangle. Consequently, it is considered no further fauna survey or assessment is required.

Several impact assessments on threatened species by the proposed action (The New Maitland Hospital) have been prepared and are comprehensive in their detail. However, there has been modification to the initial development footprint, with the assessment by pitt&sherry (2018) providing the most relevant account of the proposed impact on threatened species. This report by Forest Fauna Surveys PL (2018) was prepared to review the adequacy of the previous ecological assessments, but also to undertake a detailed assessment of the action on particular threatened species, the Squirrel Glider.

The proposed action will result in the clearing of remnant forest, either for the building footprint or maintenance of an Asset Protection Zone (APZ). One threatened fauna species, the Squirrel Glider, was recorded within the development impact area, and one bird species (Little Lorikeet) and several microbat species are likely to forage within the remnant forest or adjacent open space.

There was some inconsistency in the mapping of habitat trees by previous ecological surveys, with 2 habitat trees mapped within the Area of Influence. Consequently, an additional survey was conducted in April 2018 to review the mapping. Three habitat trees with hollows were identified within the Area of Influence by this survey. Each tree was assessed as potentially suitable for either the Squirrel Glider or tree roosting threatened microbats, based on the presence of tree hollows. Within the Area of Influence, thinning of trees is recommended for the establishment of an asset protection zone (APZ). Subject to no loss of these habitat trees, the proposed action would not to impact upon the viability of any threatened species identified in the subject site or Metford Triangle.

However, if the habitat trees within the Area of Influence are to be removed, it is recommended that species specific nest boxes are installed in retained trees within the Area of Influence, or immediately adjoining forested remnant, to offset tree hollows lost by clearing.

The review of previous ecological assessments did not discuss in detail the significance of the subject site / Metford Triangle to the local Squirrel Glider population. This species may be potentially impacted by actions such as clearing of habitat trees and fragmentation of habitat. The report by pitt&sherry (2018) identified an area of infill planting, to improve connectivity of habitat between remnant forest on the subject site and larger Metford Triangle. This action is supported. However, no detailed assessment was conducted of the viability of that population, and what measures may assist in improving longer term conservation outcomes for the Metford Triangle population.

This review therefore undertook a detailed assessment of the size and inter-connectiveness of all habitat patches suitable for the Squirrel Glider in local area. Whilst this exercise involves assessment of a larger

population than could potentially be impacted by the proposed action, the analysis is required at a strategic level (i.e. local Council) to assist in planning and management of threatened species in the subject site and wider LGA.

This review identified that most forested remnants (or habitat patches) suitable for the Squirrel Glider in the wider local area, are fragmented by gap clearings and are small in size. However, corridor connectivity between patches is not considered to be isolating in some instances, such that movements of gliders between patches is possible. Therefore, it is considered that movement of gliders between the subject site / Metford Triangle, and the nearest larger habitat patch, may occur. This suggests that the subject site population may potentially persist in the short to medium term (20 – 50 years). Habitat enhancement measures, such as supplementary plantings of the site and local vegetation corridors, may improve the connectivity, and hence, viability of this local population.

Within the subject site and Metford Triangle, threatening processes that may impact upon this population include the presence of barbed-wire on the perimeter fencing. Where this fencing intersects with forested habitat, fauna species that either fly or glide are at risk of entanglement with the wire. It is recommended that any future fencing preclude the use of barbed-wire where fencing intersects bushland.

5.0 RECOMMENDATIONS

The author supports the management and mitigation measures identified in the pitt&sherry (2018) BAR including in respect of:

- Supplementary plantings within the predominantly cleared area along the southern boundary of Lot 7314 to facilitate greater movement for the Squirrel Glider.
- Clearing protocols designed to maximise retention of habitat trees while achieving bushfire protection objectives within the APZ.
- Pre-clearing surveys for threatened fauna if clearing outside the period late February to end of May (which is the non-breeding period for hollow dependant native fauna such as microbats).
- Ecological clearing supervision if clearing habitat trees
- Nest boxes be installed at a rate of 1:1 if pre-clearing surveys identify any hollow bearing trees targeted for removal, and the hollow is occupied or there is evidence of past occupation.

In addition, the following recommendations:

- Supplementary plantings of trees along the southern boundary of the subject site to improve connectivity as per pitt&sherry Figure 11.
- Thinning of trees in the Area for APZ's to be undertaken in a way that maximises retention of the habitat trees. If habitat trees are identified for removal, these should be subject to pre-clearing surveys by a fauna ecologist, and replacement of tree hollows with nest boxes where the hollows are deemed to be viable or presently used to support nesting fauna.
- All new fencing, including security fencing associated with the New Maitland Hospital, that will intersect remnant forest on the site, avoid use of barbed wire to avoid injury / mortality to all flying / gliding fauna. Ideally, all barbed-wire fencing on the Metford Triangle that intersects remnant bushland / corridors should be removed and replaced with single strand wire.

6.0 REFERENCES

GHD (2013). *APP Corporation, Metford Quarry and Brickworks Site, Flora and Fauna Assessment.* Report by GHD, September 2013.

General Flora and Fauna (2014a). *Flora and Fauna Assessment, "the old brickworks site", Metford Road, Metford.* Report to Health Infrastructure (NSW Government). October 2014.

General Flora and Fauna (2014b). *Addendum to Flora and Fauna Assessment, GFF 14341 Over the old brickworks site, Lot 1 DP 1197061; Lot 1 DP1195590; Lot 401 DP 755237; Lot 266 DP 755237; Lot 731 DP 1162607, Metford Road, Metford.* Report to Health Infrastructure (NSW Government). December 2014.

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Appendix C

BBAM Field Data Sheets

Site value:
Transect plot data sheet

(Start a new sheet for each vegetation zone)

BioBanking
Biodiversity Banking and Offsets Scheme

CMA area	CMA subregion	Recorder	Date
Hunter		IM	19.7.17.

Proposal ID	Proposal name	Zone ID
SR17060	Metford HI	(1) LHSG1F - .

Vegetation formation KF_CH5A Dry Sclerophyll Forests (shrub/grass sub-formation)

Vegetation class Hunter-Macleay Dry Sclerophyll Forests

(PCT) **Vegetation type** Spotted gum - red ironbarke - grey gum shrub-grass open forest of the lower hunter. (PCT 1592).

Condition (low or ~~mod~~/good) ~~Good~~ Medium **Zone descriptor** (optional) **Geographic/habitat features** (tick after printing step 2 of Credit Calculator) ☐

Coordinates (GPS datum GDA94: _____)

Transect / plot number	1	2	3	4	5	6	7	8	9	10
Easting	369036	369179								
Northing	6374371	6374387								
Zone AMG	56	56								

Transect 10 points along 50-m transect (see transect tally table for % foliage cover variables)

Native over-storey cover (%)	52	66								
Native mid-storey cover (%)	65	45								
Native ground cover (grasses) (%)	0.78	0.78								
Native ground cover (shrubs) (%)	0.3	0.1								
Native ground cover (other) (%)	0.74	0.74								
Exotic plant cover	0.22	0.12								

Larger sampling area

Native plant species richness [1]	36	38								
Number of trees with hollows [2]	0	0								
Over-storey regeneration [3]	1	0.75								
Total length of fallen logs (m) [2]	3	5								

Comments/additional conservation values (riparian areas, special features, geology, etc.):

[1] 20 x 20 m plot [2] 20 x 50 m plot [3] whole zone

Site value: Transect tally table

BioBanking
Biodiversity Banking and Offsets Scheme

CMA area	CMA subregion	Recorder	Date
Hunter		IM	~~26.6.~~ 27.6.17.

Proposal ID	Proposal name	Zone ID
2017.085	Metford H1	C.mac-[illegible] EFib DSF [illegible] (LHS61F - Mod-Good-Good)

Vegetation formation	
Vegetation class	
Vegetation type	

Condition (low or mod/good)	Zone descriptor (optional)	Geographic/habitat features (tick after printing step 2 of Credit Calculator)
~~good~~ (sub) medium	1	

(sw cnr.)

Transect number METH1PL1	Number of hits (tally)	%
Native over-storey cover (%)	50 50 50 50 60 60 50 50 50 50	52
Native mid-storey cover (%)	60 70 60 60 60 70 80 70 60 60	65
Native ground cover (grasses) (%)	|||| ~~||||~~ ||| |||| ~~||||~~ || |||| ~~||||~~ |||| ||	0.78
Native ground cover (shrubs) (%)	| || | — — ||| | || || |||	0.3
Native ground cover (other) (%)	|||| |||| || ~~||||~~ ~~||||~~ ||| ||| ||| |||| ||||	0.74
Exotic plant cover (%)	— — — ~~||||~~ ~~||||~~ | — — — —	0.22

central portion of (SW remnant)

Transect number METH1PL2	Number of hits (tally)	%
Native over-storey cover (%)	60 60 50 50 50 60 60 60 60 60	66
Native mid-storey cover (%)	40 50 50 40 40 50 30 40 50 60	45
Native ground cover (grasses) (%)	||| ~~||||~~ |||| ||| ~~||||~~ ~~||||~~ || ||| ~~||||~~ ||||	0.78
Native ground cover (shrubs) (%)	| — | — | — — — — ||	0.1
Native ground cover (other) (%)	~~||||~~ || ||| ~~||||~~ ||| |||| ~~||||~~ ~~||||~~ ||| ||	0.74
Exotic plant cover (%)	| — || — || — | — — —	0.12

Transect number	Number of hits (tally)	%
Native over-storey cover (%)		
Native mid-storey cover (%)		
Native ground cover (grasses) (%)		
Native ground cover (shrub) (%)		
Native ground cover (other) (%)		
Exotic plant cover (%)		

Transect number	Number of hits (tally)	%
Native over-storey cover (%)		
Native mid-storey cover (%)		
Native ground cover grasses (%)		
Native ground cover shrubs (%)		
Native ground cover other (%)		
Exotic plant cover (%)		

Transect plot worksheet

METHI PL 1 - Garmin. SW cnr site. - clay (moist).

BioBanking
Biodiversity Banking and Offsets Scheme

Full species IDs are not required for BioBanking, but may be useful for identification of correct vegetation type and for monitoring and audit purposes.

Site type: (Development) / BioBank Proposal ID: Metford Date: 27.6.17. Recorder(s): IM

Vegetation type: C. maculata - E. fibrosa DSF shrubby (%, abund). AMG Zone MGA 56 Easting/Northing: 369036; 6374371 Photos:

Native over-storey species list At 10 points along the 50-m transect	Regeneration (√) (zone)	Native mid-storey species list (>1m to <over-storey) At 10 points along the 50-m transect	Native ground cover (grasses) species list (ground stratum <1m) At 50 points along the 50-m transect	Native ground cover (shrubs) species list (ground stratum <1m) At 50 points along the 50-m transect	Native ground cover (other) species list (ground stratum <1m) At 50 points along the 50-m transect	Exotic plants species list At 50 points along the 50-m transect	Fallen logs (min. 10 cm diameter x 50 cm long) (20 x 50m plot)
Corymbia maculata (50,22)	✓	Bursaria spinosa (80,500+)	Entolasia stricta (80,1000+)	Leucopogon juniperinus (3,20)	Pratia purpurascens (10,50)	Lantana camara (5,10)	
Euc crebra ([illegible],6)	✓	Acacia falcata (10,25)	Themeda australis (5,50+)	Micrantheum ericoides (1,3)*	Glycine clandestina (1,6)	Senecio madagascariensis (1,4)	
~~Bursaria spinosa~~		Ozothamnus diosmifolius (5,7)	Eragrostis (2,30+)	Glochidion ferdinandi (1,1)	Lomandra multiflora (2,20)	Olea europaea ssp cusp. (1,1)	
Euc fibrosa (30,5)	✓	Notelaea venosa (1,2)	eragrostis elongata / Aristida ramosa (1,10)	(young sap).	~~[illegible]~~ (2,30)	Asparagus aethiopicus (1,2)	
		Alphitonia excelsa (2,1)	Aristida vagans (3,100+)		Dianella [illegible]		
		Dillwynia retorta (2,4)	Microlaena stipoides (5,500+)		Geitonoplesium cymosum (1,2)		
		Kunzea ericoides (2,4)	Panicum simile (1,5)		Arthropodium (1,4) minus	Caesia parv. - check! basal leaves only!	
		~~[illegible]~~ (1,3)			Opercularia sp. (1,3)	diphylla	
		Daviesia ulicifolia (1,2)			Goodenia hederacea (1,2)		
		Acacia elongata (1,1) - juv.			~~[illegible]~~	~~[illegible]~~	
					Cheilanthes sieberi (1,30)		
Total number of species = 40 Foliage cover (%) = Benchmark value (%FC) = Average crown diameter = Average foliage cover (%) = Number of trees = Sample area = 0.04 ha.					Lomandra filiformis (1,4) ✓		
					Laxmannia gracilis (1,2)		
					Lepidosperma laterale (2,4)		
					Brunoniella pumilio (1,1)		
					Ptilothrix deusta (10,200+)		
Whole zone Number of trees with hollows = 0 Sample area = 0.1 ha. Benchmark value =		Total no of species = Foliage cover (%) =	Total no of species = Foliage cover (%) =	Total no of species = Foliage cover (%) =	Total no of species = Foliage cover (%) =	Total no of species = 4 Foliage cover (%) =	Total (m) = 3 Benchmark (m) =

SITE AND OTHER NOTES: * check. - regrowth stand (older + younger regrowth), good cond. 1 patch Lantana. (Mod-Good-Good Medium)

NB: Transects / plots should be placed randomly with the minimum number required for the zone in accordance with Table 4 of the Operational Manual.

Field data sheets for BioBanking : Biobank site proposal package February 2009

species legend - (cover ; abundance) = (X, Y)

Veg Structure		Height.	PFC
	Trees	to 15m	60
	Small trees (euc juvs)	to 7m	15
	shrubs.	to 4m	70

checked by IM. ☑

Transect plot worksheet

METHIPLZ — central southern portion site – 30m east of creekline on higher ground.

BioBanking Biodiversity Banking and Offsets Scheme

Full species IDs are not required for BioBanking, but may be useful for identification of correct vegetation type and for monitoring and audit purposes.

Site type: (Development) / BioBank **Proposal ID:** ______ **Date:** 27.6.17. **Recorder(s):** IM.

Vegetation type: C.mac – E.fibrosa – E.punc. DSF (shrubby) **AMG Zone** MGA 56. **Easting/Northing:** 369179; 6374381 **Photos:** ______

(%, abund.)

Native over-storey species list At 10 points along the 50-m transect	Regen-eration (√) (zone)	Native mid-storey species list (>1m to <over-storey) At 10 points along the 50-m transect	Native ground cover (grasses) species list (ground stratum <1m) At 50 points along the 50-m transect	Native ground cover (shrubs) species list (ground stratum <1m) At 50 points along the 50-m transect	Native ground cover (other) species list (ground stratum <1m) At 50 points along the 50-m transect	Exotic plants species list At 50 points along the 50-m transect	Fallen logs (min. 10 cm diameter x 50 cm long) (20 x 50m plot)
E.crebra ([illegible])	X [illegible]	Bursaria spinosa (80,500+)	Entolasia stricta (60,1000+)	Leucopogon juniperinus (2,5)	Pratia purpurascens (30,1000+)	Lantana camara (3,5)	
E.punctata (30,12)	✓	Callistemon linearis (2,5)	Microlaena stipoides (60,1000+)	Goodenia hederacea (1,1)	Cheilanthes sieberi (5,100+)		
C.maculata (20,6)	✓	Acacia falcata (5,7)	Aristida vagans (20,300)	Glochidion ferdinandi (1,3)	Lomandra multiflora (6,20+)		
E.fibrosa (30,6)	✓	Acacia elongata (1,2)	Echinopogon (tuft ? (1,3) (tuft looks like caesp)	Platylobium (seedling) (1,1)	~~Lomandra gracilis~~ (2,50)		
		Pittosporum undulatum (2,3)			Ptilothrix deusta (3,50)		
		Ozothamnus diosmifolius (1,2)			Lomandra longifolia (5,100+)		
		Notelaea venosa sp (1,1)			Hardenbergia violacea (1,20)		
		Dillwynia retorta (1,2)			Lomandra filiformis (2,10)		
		Alphitonia excelsa (1,1)			Dianella revoluta (2,20) – glaucous, maroon base.		
		Kunzea ericoides (1,2)			Opercularia sp. (seedling) (1,2) (prob. diph.)		
					Pseuderanthemum variabile purple underside (1,3)		
					Goodenia bellidifolia (seedling) (1,1)		
					Goodenia hederacea (1,1)		
					Glycine clandestina (1,4)		
					Parsonsia straminea (1,3)		
					Pandorea pandorana (1,2)		
					Lepidosperma laterale (1,2)		
		Total no of species = Foliage cover (%) =	Total no of species = Foliage cover (%) =	Total no of species = Foliage cover (%) =	Total no of species = Foliage cover (%) =	Total no of species = Foliage cover (%) =	Total (m) = 5 Benchmark (m) =

(x can.)

Total number of species = 39
Foliage cover (%) =
Benchmark value (%FC) =
Average crown diameter =
Average foliage cover (%) =
Number of trees =
Sample area = 0.04

Whole zone
Number of trees with hollows = 0
Sample area = 0.1 ha.
Benchmark value =

SITE AND OTHER NOTES: * check by IM ☑ young regrowth above creekline. moist clays. W–NW facing. 0–5° slope. low relief. no outcropping.

NB: Transects / plots should be placed randomly with the minimum number required for the zone in accordance with Table 4 of the Operational Manual.

Mod-Good- ~~Good~~ Medium

(cover, abundance) = (x, y).

Site value:
Transect plot data sheet

(Start a new sheet for each vegetation zone)

BioBanking
Biodiversity Banking and Offsets Scheme

CMA area	CMA subregion	Recorder	Date
Hunter		IM	18.7.17.

Proposal ID	Proposal name	Zone ID
SY17060		(2) LHSG1F

Vegetation formation: EF- C1H5A Dry Sclerophyll Forests (shrub/grass sub-formation)

Vegetation class: Hunter-Macleay Dry Sclerophyll Forests

Vegetation type: Spotted Gum- Red Ironbark - Grey Gum shrub-grass open forest of the lower hunter (PCT 1592).

Condition (low or mod/good)	Zone descriptor (optional)	Geographic/habitat features (tick after printing step 2 of Credit Calculator)
Poor	LHSG1F - (2)	☐

Coordinates (GPS datum GDA94: _____)

Transect / plot number	#PL3	#PL4	3 (PL5)	4 (PL6)	5	6	7	8	9	10
Easting	369716	369519	369172	369143						
Northing	6374292	6374286	6374522	6374366						
Zone AMG	56	56	56	56						

Transect 10 points along 50-m transect (see transect tally table for % foliage cover variables)

Native over-storey cover (%)	56	53	46	24						
Native mid-storey cover (%)	40	60	54	0.08						
Native ground cover (grasses) (%)	0.8	0.48	0.54	0.1						
Native ground cover (shrubs) (%)	0	0.04	0.04	0.02						
Native ground cover (other) (%)	0.44	0.6	0.4	0.06						
Exotic plant cover	0.82	0.6	0.52	0.78						

Larger sampling area

Native plant species richness [1]	~~21~~	~~23~~	29	11						
Number of trees with hollows [2]	0	0	0	1						
Over-storey regeneration [3]	1	0.66	1	0						
Total length of fallen logs (m) [2]	2.	0	0	2						

Comments/additional conservation values (riparian areas, special features, geology, etc.):

Weed infested PCT.

[1] 20 x 20 m plot [2] 20 x 50 m plot [3] whole zone

Site value:
Transect tally table

BioBanking
Biodiversity Banking and Offsets Scheme

CMA area	CMA subregion	Recorder	Date
Hunter		IM	13.7.17.

Proposal ID	Proposal name	Zone ID
SV17066	Metford brickworks - hospital.	2 (LHSG1F - Mod-Good-Poor)

Vegetation formation

Vegetation class

Vegetation type

Condition (low or mod/good): Poor

Zone descriptor (optional): LHSG1F (2)

Geographic/habitat features (tick after printing step 2 of Credit Calculator)

Transect number METHIPL3	Number of hits (tally)	%
Native over-storey cover (%)	50 60 60 60 50 50 60 60 60 50	56
Native mid-storey cover (%)	30 40 50 40 40 30 40 30 50 50	40
Native ground cover (grasses) (%)	4 3 4 2 5 2 7 3 4 4	0.8
Native ground cover (shrubs) (%)	0 →	0
Native ground cover (other) (%)	2 2 3 1 1 - 4 3 2 3	0.44
Exotic plant cover (%)	5 4 4 3 5 5 2 4 5 4	0.82

Transect number METHIPL4	Number of hits (tally)	%
Native over-storey cover (%)	50 50 50 60 60 50 50 50 50 60	53
Native mid-storey cover (%)	60 60 60 70 70 70 50 50 50 60	60
Native ground cover (grasses) (%)	3 2 2 2 - 4 3 2 3 2	0.48
Native ground cover (shrubs) (%)	- - - - - - - 1 2 2	0.1
Native ground cover (other) (%)	3 2 3 3 2 2 2 4 4 3	0.6
Exotic plant cover (%)	3 4 1 3 5 2 2 3 5 3	0.6

secondary accessed area (SW remnant)

Transect number METHIPL5	Number of hits (tally)	%
Native over-storey cover (%)	50 50 40 40 40 50 50 50 50 40	46
Native mid-storey cover (%)	50 60 60 50 50 60 60 60 40 50	54
Native ground cover (grasses) (%)	6 3 2 4 2 1 3 2 3 5	0.54
Native ground cover (shrub) (%)	- - - 1 - - - - 1 -	0.04
Native ground cover (other) (%)	2 3 2 1 - 3 - 5 3 2	0.4
Exotic plant cover (%)	3 2 - - 2 2 3 4 4 5	0.52

Transect number METHIPL6	Number of hits (tally)	%
Native over-storey cover (%)	20 20 30 30 30 20 20 30 20 20	24
Native mid-storey cover (%)	2 - - - - 1 - - 1 -	0.08
Native ground cover grasses (%)	- - - 1 3 - - - - -	0.1
Native ground cover shrubs (%)	- - - - - - - - 1 -	0.02
Native ground cover other (%)	- 1 - - - 1 - 1 - -	0.06
Exotic plant cover (%)	50 60 4 3 5 2 4 5 4 3	0.78

SW remnant ephemeral creekline.

synoum (spp.)

METHIPL3

Transect plot worksheet

Full species IDs are not required for BioBanking, but may be useful for identification of correct vegetation type and for monitoring and audit purposes.

BioBanking
Biodiversity Banking and Offsets Scheme

Site type: Development / BioBank **Proposal ID:** _____ **Date:** 13.7.17. **Recorder(s):** IM.

Vegetation type: Cmaculata-E.punctata DSF. (heavy disturbance). **AMG Zone** MGA 56 GDA94 **Easting/Northing:** 369716 E, 6374292 (SE cnr site). **Photos:** _____

Native over-storey species list At 10 points along the 50-m transect	Regeneration (√) (zone)	**Native mid-storey species list** (>1m to <over-storey) At 10 points along the 50-m transect	**Native ground cover (grasses) species list** (ground stratum <1m) At 50 points along the 50-m transect	**Native ground cover (shrubs) species list** (ground stratum <1m) At 50 points along the 50-m transect	**Native ground cover (other) species list** (ground stratum <1m) At 50 points along the 50-m transect	**Exotic plants species list** At 50 points along the 50-m transect	**Fallen logs** (min. 10 cm diameter x 50 cm long) (20 x 50m plot)
C. maculata (60,1p	✓	Bursaria spinosa (10, 20)	Themeda australis (3, 30)		Maesdenia sp.	Lantana camara (60, 100+cl.)	
E. punctata (30,3)	✓	Glochidion ferdinandi (1,3)	Aristida vagans (1,30)		Pratia purpurascens (1,50)		
(x canaliculata-che(k))		Acacia parvipinnula (1,3)	Entolasia stricta (3,200+)		Lomandra multiflora (1,10)		
		~~Amyema sp. [illegible]~~	Microlaena stipoides (2,100+)		Parsonsia straminea (30, 500+stems)		
		Pittosporum undulatum (1,2)			Lomandra filiformis fo/ brachy (1,20)		
		Ozothamnus diosmifolius (1,2)			Desmodium (1,2)		
		Dendrophthoe vitellina (1,1) - mistletoe.			Vernonia cinerea (1,1)		
					Brunoniella pumilio (1,2)		
					Pandorea pandorana (1,3)		
					Veronica plebeia (1,2)		
Total number of species = 20							
Foliage cover (%) =							
Benchmark value (%FC) =							
Average crown diameter =							
Average foliage cover (%) =							
Number of trees =							
Sample area = 0.04 ha.							
Whole zone							
Number of trees with hollows = 0							
Sample area =							
Benchmark value = 0.1 ha.		Total no of species =	Total no of species =	Total no of species =	Total no of species =	Total no of species =	Total (m) = 2
		Foliage cover (%) =	Foliage cover (%) =	Foliage cover (%) =	Foliage cover (%) =	Foliage cover (%) =	Benchmark (m) =

SITE AND OTHER NOTES: heavily Lantana infested ~50%. Mod-Good-Poor → DSF veg zone 2. Silty clay/clayey silt. - poor species richness - <5° slope. (flat).

NB: Transects / plots should be placed randomly with the minimum number required for the zone in accordance with Table 4 of the Operational Manual.

	% cover	height
Trees	60	10-12m
Shrubs	80	3m
Ground	80	1m.

checked by IM ☑

METHI PL4

Transect plot worksheet

Full species IDs are not required for BioBanking, but may be useful for identification of correct vegetation type and for monitoring and audit purposes.

Site type: Development / BioBank (circled) **Proposal ID:** ______ **Date:** 13.7.17 **Recorder(s):** IM.

Vegetation type: C maculata - E fibrosa - E globoidea DSF (heavy exotic infested) **AMG Zone** MGA56 GDA94. **Easting/Northing:** 369519; 6374286 elev 3?m. **Photos:** ______

Native over-storey species list At 10 points along the 50-m transect	Regeneration (√) (zone)	Native mid-storey species list (>1m to <over-storey) At 10 points along the 50-m transect	Native ground cover (grasses) species list (ground stratum <1m) At 50 points along the 50-m transect	Native ground cover (shrubs) species list (ground stratum <1m) At 50 points along the 50-m transect	Native ground cover (other) species list (ground stratum <1m) At 50 points along the 50-m transect	Exotic plants species list At 50 points along the 50-m transect	Fallen logs (min. 10 cm diameter x 50 cm long) (20 x 50m plot)
C. maculata (50,	18) ✓	Pitt und. (3, 3)	Entolasia stricta (5, 200+)	Glochidion fer(d) (sap)	(1,1)	Lantana camara	(70, 200+cl.)
E. fibrosa (10,	2) ✓	~~Bursaria spinosa~~	Themeda australis (2, 30)	Acacia parv (sap)	(1,2)	Asparagus aethio	picus (5, 100+ cl.)
E. globoidea (3,	1)	~~Dianella~~	Aristida vagans (1, 30)				
			Microlaena stipoides (2, 30)		Pratia purp. (1, 100+)		
			Echinopogon caesp. (10)	(1,2)	Caesia (parv. ?)	(1, 30) - basal	leaves only.
					Lomandra fil coriacea	(5, 100+)	
		Daviesia ulicifolia (2, 6)			Lomandra multiflora	(1, 5) ← check	aper feth.
		Bursaria spinosa (10, 20)				Ligustrum sinense	(2, 5)
		Pandorea pandorana (1, 2)				~~[illegible]~~	
						~~Asparagus aethiopicus~~	
					Veronica plebeia (1, 3)		
					Lomandra fil fil. (1, 6)		
Total number of species = 26					Dian reve. (1, 6)		
Foliage cover (%) =					Juncus usitatus (1, 7)		
Benchmark value (%FC) =					Hardenbergia violacea (1, 3)		
Average crown diameter =					Viola odorata (1, 3)		
Average foliage cover (%) =							
Number of trees =							
Sample area = 0.04 ha.							
Whole zone							
Number of trees with hollows = 0							
Sample area = 0.1 ha		Total no of species =	Total no of species =	Total no of species =	Total no of species =	Total no of species =	Total (m) = 0
Benchmark value =		Foliage cover (%) =	Foliage cover (%) =	Foliage cover (%) =	Foliage cover (%) =	Foliage cover (%) =	Benchmark (m) =

SITE AND OTHER NOTES: - heavy Lantana infestation in m/s. > 50%. species richness poor. (Mod-Good-Poor. (veg zone 2).)

NB: Transects / plots should be placed randomly with the minimum number required for the zone in accordance with Table 4 of the Operational Manual.

Structure -

Trees	60%	12m
Shrubs	70%	4m
Ground	60%	1m.

checked by IM ☑

METHI PL5 - Area proposed for secondary access road.

Transect plot worksheet

Full species IDs are not required for BioBanking, but may be useful for identification of correct vegetation type and for monitoring and audit purposes.

BioBanking
Biodiversity Banking and Offsets Scheme

Site type: Development / BioBank **Proposal ID:** _____ **Date:** 13.7.17 **Recorder(s):** IM

Vegetation type: C. maculata - E. punctata DSF. **AMG Zone** MGA56 GDA94 **Easting/Northing:** 369172; 6374522 elev 23m. **Photos:** _____

Native over-storey species list At 10 points along the 50-m transect	Regeneration (√) (zone)	**Native mid-storey species list** (>1m to <over-storey) At 10 points along the 50-m transect	**Native ground cover (grasses) species list** (ground stratum <1m) At 50 points along the 50-m transect	**Native ground cover (shrubs) species list** (ground stratum <1m) At 50 points along the 50-m transect	**Native ground cover (other) species list** (ground stratum <1m) At 50 points along the 50-m transect	**Exotic plants species list** At 50 points along the 50-m transect	**Fallen logs** (min. 10 cm diameter x 50 cm long) (20 x 50m plot)
C. maculata (40, 14) ✓		B. sphosa (60, 100+)	Entolasia stricta (10, 300+)			Lantana camara (20, 100 cl.+)	
E. punctata (10, 3) ✓		Leucopogon juniperinus (1, 3)		Elachidium ferd. (spp) (1, 3)			
X can.		Acacia elongata (5, 20)	Aristida ramosa (2, 50+)		Pratia purp. (1, 10+)		
		Rift. und. (5, 20)	Themeda australis (2, 30)		Lomandra multiflora (1, 10)		
		Acacia parv (2, 4) (1, 3)	Imperata cylindrica (3, 100+)			Lily? (10) (3, 50+) → new seedlings	
		Dillwynia retorta (3, 30)	Microlaena stipoides (1, 30)			Ligustrum sinense (2, 20)	
		Parsonsia stigmisa	Eragrostis elongata (1, 8)		(1, 8)		
		Alloca. lit. (1, 2)	Panicum elongata s. mile. (1, 4)		Cheilanthes sieberi	vine (per PL4) (2, 20)	
					Pandorea pand (1, 5)		
					Goodenia hederacea (1, 6)		
					Hardenbergia violacea (1, 4)		
					Lomandra ~~filiformis~~ longifolia (3, 20+)		
					Selaginella uliginosa (1, 2)		
					Juncus ~~sp.~~ (1, 2)		
					Opercularia diphylla (1, 3)		
					Dianella rev. (1, 8)		
Total number of species = 33							
Foliage cover (%) =							
Benchmark value (%FC) =							
Average crown diameter =							
Average foliage cover (%) =							
Number of trees =							
Sample area = 0.04 ha.							
Whole zone							
Number of trees with hollows = 0							
Sample area = 0.1 ha.							
Benchmark value =		Total no of species =	Total no of species =	Total no of species =	Total no of species =	Total no of species =	Total (m) = 0
		Foliage cover (%) =	Foliage cover (%) =	Foliage cover (%) =	Foliage cover (%) =	Foliage cover (%) =	Benchmark (m) =

SITE AND OTHER NOTES: - appears to be an dumped fill material. Lantana > 50%. Moderate - Good - Poor.
- dense Lantana, Bursaria.

NB: Transects / plots should be placed randomly with the minimum number required for the zone in accordance with Table 4 of the Operational Manual.

IM checked ☑

METHI PL6 — creekline plot

Transect plot worksheet

Full species IDs are not required for BioBanking, but may be useful for identification of correct vegetation type and for monitoring and audit purposes.

Site type: ~~Development~~ / BioBank **Proposal ID:** Mars Park **Date:** ~~19.4.17~~ 13.7.17 **Recorder(s):** ~~[illegible]~~ IM.

Vegetation type: ~~(Derived Grassland) Disturbed~~ **AMG Zone** 56. GDA94. **Easting/Northing:** 369143; 6374366 **Photos:**

E. fibrosa - E. punc. - C mac MSF. (exotic u/s).

Native over-storey species list At 10 points along the 50-m transect	Regen-eration (√) (zone)	Native mid-storey species list (>1m to <over-storey) At 10 points along the 50-m transect	Native ground cover (grasses) species list (ground stratum <1m) At 50 points along the 50-m transect	Native ground cover (shrubs) species list (ground stratum <1m) At 50 points along the 50-m transect	Native ground cover (other) species list (ground stratum <1m) At 50 points along the 50-m transect	Exotic plants species list At 50 points along the 50-m transect	Fallen logs (min. 10 cm diameter x 50 cm long) (20 x 50m plot)
E. fibrosa (20,4)	-	~~Lit~~	~~Microlaena stipoides~~			~~Setaria gracilis~~	
(xcap) E. punctata (5,2)	-		Entolasia stricta (1,20)				
C. maculata (20,2)	-	~~Glochidion f~~	Oplismenus imbecillis -?	no flower. larger leaf (1,30)		Ligustrum sinense -	dom. M/S (30,20+)
				Synoum glandulosum (sap) (1,1)		Senna pendula (1D) -	" " (5,10)
		Glochidion ferdinandi (2,2)				Ehrharta erecta (2,20)	
		~~Camphor laurel~~				Olea europaea (2,2)	
		Breynia oblongifolia (1,1)					
					Pandorea pandorana (1,2)		
						fish (chive-like) (1D)	(1,3)
						Camphor laurel -	dom M/S (10,7)
						Lantana camara*	(10,10)
						Jacaranda (1,1)	
						Ochna serrulata (1,1)	
					Cayratia clematidea (1,2)		
					Oxalis sp. (1D) (1,2)	Seedl. prob. perennial?	
Total number of species = 20 Foliage cover (%) = Benchmark value (%FC) = Average crown diameter = Average foliage cover (%) = Number of trees = Sample area = 0.04ha							
Whole zone Number of trees with hollows = 1 Sample area = Benchmark value = 0.1ha		Total no of species = Foliage cover (%) =	Total no of species = Foliage cover (%) =	Total no of species = Foliage cover (%) =	Total no of species = Foliage cover (%) =	Total no of species = Foliage cover (%) =	Total (m) = 2 Benchmark (m) =

SITE AND OTHER NOTES:
Mod - Good - Poor.
- sewage / stormwater drain. - 8m wide broad shallow depression with gentle banks
- defined bed in places; standing water in places.
- silty clay/clayey silt. - flat.

NB: Transects / plots should be placed randomly with the minimum number required for the zone in accordance with Table 4 of the Operational Manual.

u/s dominated by L. sinense, Senna, Camphor, Lantana.

- veg zone 2 (Mod - Good - Poor).

IM checked ☑

Site value:
Transect tally table

BioBanking
Biodiversity Banking and Offsets Scheme

CMA area	CMA subregion	Recorder	Date
Hunter		IM	12.7.17.

Proposal ID	Proposal name	Zone ID
Metford H1	H1 Hospital.	(3) – Acacia regrowth / plantings*

LHSCIF regrowth ?

Vegetation formation	
Vegetation class	
Vegetation type	

Condition (low or mod/good)	Zone descriptor (optional)	Geographic/habitat features (tick after printing step 2 of Credit Calculator)
*	T8A.	

Transect number METHIREHAB1	Number of hits (tally)	%
Native over-storey cover (%)	0 0 0 5 5 0 0 0 0 5	1.5
Native mid-storey cover (%)	30 30 40 40 40 50 40 40 40 30	38
Native ground cover (grasses) (%)	IIII IIII IIII IIII III IIII IIII IIII III IIII	0.86
Native ground cover (shrubs) (%)	0 →	0
Native ground cover (other) (%)	II III I – IIII II II III II –	0.38
Exotic plant cover (%)	IIII IIII III IIII II III IIII IIII II III	0.72

Transect number METHIREHAB2	Number of hits (tally)	%
Native over-storey cover (%)	5 10 10 10 5 0 0 0 0 0	4
Native mid-storey cover (%)	10 20 10 10 20 10 10 20 10 20	14
Native ground cover (grasses) (%)	I II – – – III – II – II	0.2
Native ground cover (shrubs) (%)	0 →	0
Native ground cover (other) (%)	II II II III I – II III – IIII	0.42
Exotic plant cover (%)	III IIII III IIII II III – III III III	0.62

Transect number_____	Number of hits (tally)	%
Native over-storey cover (%)		
Native mid-storey cover (%)		
Native ground cover (grasses) (%)		
Native ground cover (shrub) (%)		
Native ground cover (other) (%)		
Exotic plant cover (%)		

Transect number_____	Number of hits (tally)	%
Native over-storey cover (%)		
Native mid-storey cover (%)		
Native ground cover grasses (%)		
Native ground cover shrubs (%)		
Native ground cover other (%)		
Exotic plant cover (%)		

* some regrowth areas do support young E. tereticornis trees to 5m height.

METHI REHAB 1

Transect plot worksheet

BioBanking
Biodiversity Banking and Offsets Scheme

Full species IDs are not required for BioBanking, but may be useful for identification of correct vegetation type and for monitoring and audit purposes.

Site type: (Development) / BioBank **Proposal ID:** Hetford #1 **Date:** 12.7.2017 **Recorder(s):** IM

Vegetation type: shrub plantings / acacia regrowth. **AMG Zone** MSA 56 GDA 94 **Easting/Northing:** 389484; 6374502 **Photos:**

Native over-storey species list At 10 points along the 50-m transect	**Regen-eration** (√) (zone)	**Native mid-storey species list** (>1m to <over-storey) At 10 points along the 50-m transect	**Native ground cover (grasses) species list** (ground stratum <1m) At 50 points along the 50-m transect	**Native ground cover (shrubs) species list** (ground stratum <1m) At 50 points along the 50-m transect	**Native ground cover (other) species list** (ground stratum <1m) At 50 points along the 50-m transect	**Exotic plants species list** At 50 points along the 50-m transect	**Fallen logs** (min. 10 cm diameter x 50 cm long) (20 x 50m plot)
2 Casuarina glauca (?,6)		Acacia elongata (70,100+)	~~Paspalum distichum~~ stet	~~(70,100+)~~	~~Dianella revoluta~~	Andropogon virginicus	(2,20)
euc sapling (1D) (1,1)		Acacia parviflora (1,3)	Eragrostis sp. (1D)		Centella asiatica (3,200)	Plantago lanceolata	(20,500+)
seedling		Melaleuca armillaris (1,2)	Sporobolus creber (2,50+) ✓		Lomandra longifolia (2,20)	Lantana camara (5,	20)
		Acacia falcata (3,5)	Themeda australis (1,4)		Cheilanthes sieberi (2,50)	Senecio madagascariensis	(5,100+)
		Bursaria spinosa (2,6)	Poa spp. (2,10) — no s/head.		Hydrocotyle peduncularis (1,50)	Verbena bonariensis	(2,30)
			Poa sp. — no shead (2,20) ← prob. annua.		Bacopa monnieri ? (1D) (1,10)	Setaria parviflora	(1,30)
			Cynodon dactylon (70,100)			Bidens pilosa. (1,	20)
			Eragrostis elongata (1,3)		Dianella revoluta (1,6)	Axonopus fissifolius stet	(5,100+)
						basal rosette - tomentose. Silybum?	(1,10)
						Paspalum dilatatum	(1,5)
						~~Cynodon dactylon~~	~~(3,50)~~
						Melinus repens.	(2,20).
						~~Sida rhombifolia~~ ✓	(1,4)
						Abutilon sp.?	— (1D)
Total number of species = Foliage cover (%) = Benchmark value (%FC) = Average crown diameter = Average foliage cover (%) = Number of trees = Sample area =							
Whole zone Number of trees with hollows = Sample area = Benchmark value =		Total no of species = Foliage cover (%) =	Total no of species = Foliage cover (%) =	Total no of species = Foliage cover (%) =	Total no of species = Foliage cover (%) =	Total no of species = Foliage cover (%) =	Total (m) = Benchmark (m) =

SITE AND OTHER NOTES: natives planted - C. glauca prob. naturally recruited. low condition SGIF? Exotic groundcover. low lying area. — silty mud/muddy silt.

NB: Transects / plots should be placed randomly with the minimum number required for the zone in accordance with Table 4 of the Operational Manual.

METREHAB2

Transect plot worksheet

Full species IDs are not required for BioBanking, but may be useful for identification of correct vegetation type and for monitoring and audit purposes.

BioBanking
Biodiversity Banking and Offsets Scheme

Site type: Development / BioBank (circled) **Proposal ID:** Metford H1 **Date:** 12.7.17. **Recorder(s):** 1M.

Vegetation type: Rehab plantings (~~E. ter. reg. woodland~~) (Acacia regrowth) **AMG Zone** MGA56 GDA94 **Easting/Northing:** 369619; 6374392 **Photos:**

Native over-storey species list At 10 points along the 50-m transect	Regeneration (√) (zone)	**Native mid-storey species list** (>1m to <over-storey) At 10 points along the 50-m transect	**Native ground cover (grasses) species list** (ground stratum <1m) At 50 points along the 50-m transect	**Native ground cover (shrubs) species list** (ground stratum <1m) At 50 points along the 50-m transect	**Native ground cover (other) species list** (ground stratum <1m) At 50 points along the 50-m transect	**Exotic plants species list** At 50 points along the 50-m transect	**Fallen logs** (min. 10 cm diameter x 50 cm long) (20 x 50m plot)
E. tereticornis (5, 10)		Bursaria spinosa (10, 20)		~~Sida rhombifolia~~ (2, 20)		Centaurea rapens (10, 20 cl.)	
(young trees) (sap)		Acacia parvipinnula ~~sp. (light yellow flow.)~~ (10, 20)		Abutilon sp. (10) -		Paspalum urvillei (1, 2)	
		Ozothamnus diosmifolius (2, 6)			Centella asiatica (2, 100+)		
		Acacia filata (2, 4)			Hydrocotyle sp. peda (10) (2, 200+)	– check peduncle	
			Themeda australis (2, 50)		Dichondra repens (1, 50+)		
			Axonopus fissifolius (1, 20)				
		Leucopogon juniperinus (1, 4)	Cynodon dactylon (10, 300+)			Plantago lanceolata (1, 5)	
			Imperata cylindrica var major (1, 10)		Blechnum ambiguum		
		Glochidion ferdinandi (3, 4)			~~[illegible]~~ (1, 2)	– edge drainage channel	
		Acacia elongata (3, 6)		Pimelea linifolia (1, 3)			
		Pultenaea villosa (1, 2)			Cheilanthes sieberi (1, 20)		
						Verbena bonariensis (1, 5)	
Total number of species =					Oxalis perennans (1, 10)	Senecio madagascariensis (1, 10)	
Foliage cover (%) =					Pratia purpurascens (1, 30)	[illegible] (2, 30)	
Benchmark value (%FC) =					Goodenia bellidifolia (1, 10)	Paspalum dilatatum (1, 2)	
Average crown diameter =					Glycine clandestina (10) (1, 3)		
Average foliage cover (%) =					Dianella revoluta (1, 6)		
Number of trees =					Hardenbergia violacea (1, 2)		
Sample area =					Lomandra longifolia (1, 3)		
Whole zone Number of trees with hollows =					Einadia hastata (2, 2 cl.)		
Sample area =		Total no of species =	Total no of species =	Total no of species =	Total no of species =	Total no of species =	Total (m) =
Benchmark value =		Foliage cover (%) =	Foliage cover (%) =	Foliage cover (%) =	Foliage cover (%) =	Foliage cover (%) =	Benchmark (m) =

SITE AND OTHER NOTES: brickpit floor

NB: Transects / plots should be placed randomly with the minimum number required for the zone in accordance with Table 4 of the Operational Manual.

	% PFC	Height (m)
Trees	5-10	to 7m
shrubs	50	to 3m
ground	[illegible]	[illegible]

Site value:
Transect tally table

BioBanking
Biodiversity Banking and Offsets Scheme

CMA area	CMA subregion	Recorder	Date
Hunter		JM.	12.7.17.

Proposal ID	Proposal name	Zone ID
Metford H1	H1 Hospital SS1	(4) freshwater wetland ponds

Vegetation formation

Vegetation class

Vegetation type

Condition (low or mod/good) **Zone descriptor** (optional) **Geographic/habitat features** (tick after printing step 2 of Credit Calculator)

METHPOND1

Transect number ~~WETLAND~~	Number of hits (tally)	%
Native over-storey cover (%)	10 0 0 0 0 0 0 0 0 0	1
Native mid-storey cover (%)	0 →	0
Native ground cover (grasses) (%)	II II I - - I - III II III	0.28
Native ground cover (shrubs) (%)	0 →	0
Native ground cover (other) (%)	IIII IIII IIII IIII IIII IIII IIII III IIII IIII	0.88
Exotic plant cover (%)	IIII IIII IIII IIII IIII IIII I - - - - - - - - -	0.1

Transect number METHPOND2	Number of hits (tally)	%
Native over-storey cover (%)	10 0 →	1
Native mid-storey cover (%)	0 →	0
Native ground cover (grasses) (%)	0 III II IIII I 0 →	0.2
Native ground cover (shrubs) (%)	0 →	0
Native ground cover (other) (%)	IIII IIII IIII IIII III IIII IIII IIII IIII IIII	0.9
Exotic plant cover (%)	II I - I - II - - - I	0.14

Transect number_____	Number of hits (tally)	%
Native over-storey cover (%)		
Native mid-storey cover (%)		
Native ground cover (grasses) (%)		
Native ground cover (shrub) (%)		
Native ground cover (other) (%)		
Exotic plant cover (%)		

Transect number_____	Number of hits (tally)	%
Native over-storey cover (%)		
Native mid-storey cover (%)		
Native ground cover grasses (%)		
Native ground cover shrubs (%)		
Native ground cover other (%)		
Exotic plant cover (%)		

METPOND 1

Transect plot worksheet

Full species IDs are not required for BioBanking, but may be useful for identification of correct vegetation type and for monitoring and audit purposes.

BioBanking
Biodiversity Banking and Offsets Scheme

Site type: (Development) / BioBank **Proposal ID:** Hetford Hl **Date:** 12.7.17 **Recorder(s):** IM-

Vegetation type: Typha orientalis reedland **AMG Zone** MGA 56 GDA 94 **Easting/Northing:** 369481; 6374466 **Photos:**

Native over-storey species list At 10 points along the 50-m transect	Regen-eration (√) (zone)	**Native mid-storey species list** (>1m to <over-storey) At 10 points along the 50-m transect	**Native ground cover (grasses) species list** (ground stratum <1m) At 50 points along the 50-m transect	**Native ground cover (shrubs) species list** (ground stratum <1m) At 50 points along the 50-m transect	**Native ground cover (other) species list** (ground stratum <1m) At 50 points along the 50-m transect	**Exotic plants species list** At 50 points along the 50-m transect	**Fallen logs** (min. 10 cm diameter x 50 cm long) (20 x 50m plot)
C. gleuca (2, 50)			Cynodon dactylon (10, 500+)		Typha orientalis (80, 1000+)		
					Juncus usitatus (fringes of pond) (20, 300+)		
					Phyllodium pulchellum (5, 50+)		
					Baumea articulata (10, 200)		
					Persicaria stigosa (1, 2)		
						Andropogon virginicus (20, 200+)	
Total number of species =							
Foliage cover (%) =							
Benchmark value (%FC) =							
Average crown diameter =							
Average foliage cover (%) =							
Number of trees =							
Sample area = 0.04 ha.							
Whole zone							
Number of trees with hollows = 0							
Sample area = 0.1 ha.							
Benchmark value =		Total no of species =	Total no of species =	Total no of species =	Total no of species =	Total no of species =	Total (m) =
		Foliage cover (%) =	Foliage cover (%) =	Foliage cover (%) =	Foliage cover (%) =	Foliage cover (%) =	Benchmark (m) =

SITE AND OTHER NOTES: - pond formed from brickpit floor landform + access tracks. ← water depth 10cm → 0.1m.

NB: Transects / plots should be placed randomly with the minimum number required for the zone in accordance with Table 4 of the Operational Manual.

METH1 POND 2

Transect plot worksheet

Full species IDs are not required for BioBanking, but may be useful for identification of correct vegetation type and for monitoring and audit purposes.

BioBanking
Biodiversity Banking and Offsets Scheme

Site type: Development / (BioBank) **Proposal ID:** Metford H1 **Date:** 12.7.17 **Recorder(s):** IM

Vegetation type: B. articulata - Eleocharis sp. sedgeland **AMG Zone** MGA 56 GDA94 **Easting/Northing:** 369579; 6374403 **Photos:**

Native over-storey species list At 10 points along the 50-m transect	Regeneration (√) (zone)	Native mid-storey species list (>1m to <over-storey) At 10 points along the 50-m transect	Native ground cover (grasses) species list (ground stratum <1m) At 50 points along the 50-m transect	Native ground cover (shrubs) species list (ground stratum <1m) At 50 points along the 50-m transect	Native ground cover (other) species list (ground stratum <1m) At 50 points along the 50-m transect	Exotic plants species list At 50 points along the 50-m transect	Fallen logs (min. 10 cm diameter x 50 cm long) (20 x 50m plot)
C. glauca (1,2)			Cynodon dactylon (3,50+)		~~M. quinquenervia~~		
E. tereticornis (1,1)							
				M. quinquenervia (sapl.) (1,1)			
					Baumea articulata (30,500+)		
					Juncus usitatus (5,50)		
					Cyperus eragrostis (2,20)		
					Eleocharis equis sp. (50,1000+)		
					Phyllodum longifolium (1,3) → equisitena.		
						Andropogon virginicus (1,3) ← check ID.	
Total number of species =						Juncus (acutus) (fibre) (1,2)	
Foliage cover (%) =							
Benchmark value (%FC) =							
Average crown diameter =							
Average foliage cover (%) =							
Number of trees =							
Sample area = 0.04 ha.							
Whole zone							
Number of trees with hollows =							
Sample area = 0.1 ha.		Total no of species =	Total no of species =	Total no of species =	Total no of species =	Total no of species =	Total (m) =
Benchmark value =		Foliage cover (%) =	Foliage cover (%) =	Foliage cover (%) =	Foliage cover (%) =	Foliage cover (%) =	Benchmark (m) =

SITE AND OTHER NOTES: pond created from brickpit floor landform + track construction. Water depth variable 5cm ⇒ 0.75m. Crinia sig. calling. No Limno calling.

NB: Transects / plots should be placed randomly with the minimum number required for the zone in accordance with Table 4 of the Operational Manual.

Appendix D

Lower Hunter Spotted Gum Ironbark Forest (LHSGIF) Community Profile and BBAM Plot Data

Appendix B
Lower Hunter Spotted Gum Ironbark Forest Vegetation Community Profile
(as recorded on HI Metford site in June/July 2017)

LHSGIF remnant (moderate/good-medium) condition class on Lot 7314

LHSGIF remnant (moderate/good-poor) condition class on Lot 7314 (>50% cover of Lantana in midstorey)

Occurrence - This community was recorded on siltstone/mudstone-derived clays along the western and southern boundaries of Lot 7314. The community supported a mixed aged cohort of younger and older regrowth with occasional older remnant trees.

Community Equivalencies –. Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (PCT ID 1592)

Conservation Status – Analagous to the Lower Hunter Spotted Gum-Ironbark Forest of the Sydney Basin EEC (BC Act).

Floristics and Vegetative Structure

Stratum	% Cover Range	Height Range (m)	Floristics
Trees	40-60	8-15	*Corymbia maculata, Eucalyptus fibrosa, Eucalyptus globoidea, Eucalyptus punctata* x *canaliculata, Eucalyptus crebra*
Small Trees	10-20	4-7	Mod/good – medium ecotype – *Alphitonia excelsa* South-western remnant creekline in mod/good (poor) condition moist LHSGIF ecotype - *Glochidion ferdinandi, Ligustrum sinense*, Camphora cinnamomum*, Ligustrum lucidum*, Pittosporum undulatum, Senna pendula* var *glabrata**
Shrubs	40-70	1-4	*Bursaria spinosa, Acacia parvipinnula, Acacia elongata, Acacia falcata, Notelaea venosa, Callistemon linearis, Kunzea ericoides, Dillwynia retorta, Ozothamnus diosmifolius, Daviesia ulicifolia, Lantana camara**(>50% Lantana cover in mod/good-poor ecotype), *Ochna serrulata**
Groundcover (grasses, forbs, graminoids, ferns, subshrubs)	90	<1.2	*Dianella revoluta, Microlaena stipoides, Themeda australis, Echinopogon caespitosus, Hardenbergia violacea, Imperata cylindrica* var *major, Entolasia stricta, Lomandra multiflora* subsp *multiflora, Aristida vagans, Panicum simile, Aristida ramosa, Pratia purpurascens, Cheilanthes sieberi, Lomandra filiformis, Laxmannia gracilis, Lepidosperma laterale, Caesia parviflora, Opercularia diphylla, Goodenia hederacea, Brunoniella pumilio, Ptilothrix deusta, Eragrostis elaongata, Panicum simile, Leucopogon juniperinus, Micrantheum ericoides, Veronica plebeia, Vernonia cinerea, Desmodium brachypodum*
All strata (climbers, mistletoe in tree canopy only)			*Parsonsia straminea, Pandorea pandorana, Glycine clandestina, Eustrephus latifolius, Geitonoplesium cymosum, Dendrophthoe vittelina*

Table B-1 **Floristic List for Biobank Assessment, Lot 7314 DP July 2017 (6 LHSGIF plots)**
Note: cell values are presented as %cover and (abundance) as per BBAM (2014)

Class/Family	Scientific Name	Biobank Plot Data					
		PL1	PL2	PL3	PL4	PL5	PL6
CLASS LYCOPSIDA (Clubmosses and Quillworts)							
SELAGINELLACEAE	*Selaginella uliginosa*					*1(2)*	
CLASS FILICOPSIDA (Ferns)							
PTERIDACEAE	*Cheilanthes sieberi*	1(30)	*5(100+)*			*1(8)*	
CLASS MAGNOLIOPSIDA (Flowering Plants)							
Subclass Magnoliidae (Dicotyledons)							
ACANTHACEAE	*Brunoniella pumilio*	1(1)		1(2)			
	Pseuderanthemum variabile		1(3)				
ANTHERICACEAE	*Caesia (parviflora?)* – no repr. material	1(4)			1(30)		
	Laxmannia gracilis	1(2)					
APIACEAE	*Parsonsia straminea*		*1(3)*	*30(500+)*		*3(30)*	
ASPARAGACEAE	*Asparagus aethiopicus**	*1(2)*			*5(100+)*		
ASTERACEAE	*Ozothamnus diosmifolius*	*5(7)*	*1(2)*	*1(2)*			
	*Senecio madagascariensis**	*1(4)*					
	Vernonia cinerea			*1(1)*			
BIGNONIACEAE	*Pandorea pandorana*		1(2)	1(3)	1(2)	1(5)	1(2)
	*Jacaranda mimosifolia**						1(1)

CASUARINACEAE	*Allocasuarina littoralis*					1(2)	
ERICACEAE: Styphelioideae	*Leucopogon juniperinus*	3(20)	2(5)			1(3)	
FABACEAE: Caesalpinioideae	*Senna pendula* var. *glabrata**						5(10)
FABACEAE: Faboideae	*Desmodium brachypodum*			1(2)			
	Daviesia ulicifolia	1(2)			2(6)		
	Dillwynia retorta	2(4)	1(2)			1(3)	
	Glycine clandestina	1(6)	1(4)				
	Hardenbergia violacea		1(20)		1(3)	1(4)	
	Platylobium formosum? - seedling		1(1)				
FABACEAE: Mimosoideae	*Acacia elongata*	1(1)	1(2)			5(20)	
	Acacia parvipinnula			1(3)	1(2)	2(4)	
	Acacia falcata	10(25)	5(7)				
GOODENIACEAE	*Goodenia bellidifolia* subsp *bellidifolia*		1(1) - seedling				
	Goodenia hederacea	1(2)	1(1)			1(6)	
LAURACEAE	*Cinnamomum camphora**						10(7)
LOBELIACEAE	*Pratia purpurascens*	*10(500)*	*30(1000+)*	*1(50)*	*1(100+)*	*1(100)*	
LORANTHACEAE	*Dendrophthoe vittelina*			*1(1)*			
LUZURIAGACEAE	*Geitonoplesium cymosum*	*1(2)*					
MELIACEAE	*Synoum glandulosum*						*1(1)*

MYRTACEAE	*Eucalyptus punctata x canaliculata*		*30(12)*	*20(3)*	*10(3)*		*5(2)*
	Eucalyptus fibrosa	*30(5)*	*30(6)*	*10(2)*			*20(4)*
	Eucalyptus crebra	*5(6)*	*3(1)*				
	Eucalyptus globoidea			*3(1)*			
	Corymbia maculata	*50(22)*	*20(6)*	*60(10)*	*50(18)*	*40(14)*	*20(2)*
	Callistemon linearis		2(5)				
	Kunzea ericoides	2(4)	1(2)				
OCHNACEAE	*Ochna serrulata*						1(1)
OLEACEAE	*Olea europaea* subsp. *cuspidata*	1(1)					2(2)
	*Ligustrum sinense**				2(5)	2(20)	30(200+)
	Notelaea venosa	1(2)	1(1)				
OXALIDACEAE	*Oxalis perennans*						1(2)
PHYLLANTHACEAE	*Breynia oblongifolia*						1(1)
	Glochidion ferdinandi var. *ferdinandi*	1(1)	1(2)	1(3)	1(1)	1(3)	2(2)
PICRODENDRACEAE	*Micrantheum ericoides*	1(3)					
PITTOSPORACEAE	*Pittosporum undulatum*		2(3)	1(2)	3(3)	5(20)	
	Bursaria spinosa	80(500+)	80(500+)	10(20)	10(20)	60(100+)	
PLANTAGINACEAE	*Veronica plebeia*			1(2)	1(3)		
RHAMNACEAE	*Alphitonia excelsa*	2(1)	1(1)				

	Opercularia diphylla	1(3)	1(2)			1(3)	
VERBENACEAE	*Lantana camara**	5(10)		60(100+)	70(200+)	20(100+)	10(10)
VIOLACEAE	*Viola odorata**				1(3)		
VITACEAE	*Cayratia clematidea*						1(2)
CLASS MAGNOLIOPSIDA (Flowering Plants)							
Subclass Liliidae (Monocotyledons)							
CYPERACEAE	*Lepidosperma laterale*	2(4)	1(2)				
	Ptilothrix deusta	10(200+)	3(50)				
JUNCACEAE	*Juncus usitatus*				1(7)	1(2)	
LOMANDRACEAE	*Lomandra multiflora* subsp *multiflora*	2(20)	2(20+)	1(10)	1(5)	1(10)	
	Lomandra longifolia subsp *longifolia*		5(100+)			3(20+)	
	Lomandra filiformis subsp *coriacea*				5(100+)		
	Lomandra filiformis subsp *filiformis*	1(4)	2(10)	1(20)	1(6)		
PHORMIACEAE	*Dianella revoluta*	2(30)	2(20)		1(6)	1(8)	
POACEAE	*Aristida ramosa*	1(10)				2(50+)	
	Aristida vagans	3(100+)	20(300+)	1(30)	2(30)		
	Echinopogon (caespitosus?) – no seedhead		1(3)		1(2)		
	Entolasia stricta	80(1000+)	60(1000+)	3(200+)	5(200+)	10(300+)	1(20)
	Eragrostis elongata	2(30+)				1(8)	

	*Erharta erecta**						2(20)
	Imperata cylindrica var. *major*					3(100+)	
	Microlaena stipoides	5(500+)	60(1000+)	2(100+)	2(30)	1(30)	
	Oplismenus imbecillis						1(30)
	Panicum simile	1(5)				1(4)	
	Themeda australis	5(50+)		3(30)	2(30)	2(30)	

Table B-2 **Floristic List for Biobank Assessment, Lot 7314 DP July 2017 (4 plots in stormwater ponds and Acacia plantings)**
Note: cell values are presented as %cover and (abundance) as per BBAM (2014)

Class/Family	Scientific Name	Biobank Plot Data			
		Rehab1	Rehab2	Pond1	Pond2
CLASS FILICOPSIDA (Ferns)					
BLECHNACEAE	*Blechnum ambiguum*		*1(2)* – edge drainage channel		
PTERIDACEAE	*Cheilanthes sieberi*	*2(50)*	*1(20)*		
CLASS MAGNOLIOPSIDA (Flowering Plants)					
Subclass Magnoliidae (Dicotyledons)					
APIACEAE	*Centella asiatica*	*3(200)*	*2(100+)*		
ARALIACEAE	*Hydrocotyle sibthorpioides*	*1(50)*	*2(200+)*		
ASTERACEAE	*Ozothamnus diosmifolius*		*2(6)*		
	*Senecio madagascariensis**	*5(100+)*	*1(10)*		
	Bidens pilosa	*1(20)*			
	*Silybum marianum? (*seedlings*)*	*1(10)*			
	Taraxacum officinale		*2(30)*		
CASUARINACEAE	*Casuarina glauca*			2(5)	1(2)
CHENOPODIACEAE	*Einadia hastata*		2(2 clumps)		
CONVOLVULACEAE	*Dichondra repens*		1(50+)		

ERICACEAE: Styphelioideae	*Leucopogon juniperinus*		1(4)		
	Glycine clandestina		1(3)		
	Hardenbergia violacea		1(2)		
	Pultenaea villosa		1(2)		
FABACEAE: Mimosoideae	*Acacia elongata*	70(100+)	3(6)		
	Acacia parvipinnula	1(3)			
	Acacia falcata	3(5)	2(4)		
GOODENIACEAE	*Goodenia bellidifolia* subsp *bellidifolia*		1(10)		
LOBELIACEAE	*Pratia purpurascens*		*1(30)*		
MALVACEAE	*Abutilon sp?. (*seedlings*)*	*1(10)*	*2(20)*		
MYRTACEAE	*Eucalyptus tereticornis*	*5(10)*			*1(1)*
	Melaleuca armillaris	1(2)			
	Melaleuca quinquenervia				1(1) - sapling
OXALIDACEAE	*Oxalis perennans*		1(10)		
PITTOSPORACEAE	*Bursaria spinosa*	2(6)	10(20)		
PLANTAGINACEAE	*Bacopa monnieri?* (seedlings*)*	1(10)			
	*Plantago lanceolata**	20(500+)	1(5)		
THYMELAEACEAE	*Pimelea linifolia*	1(3)			
VERBENACEAE	*Lantana camara**	5(20)	10(20 clumps/thickets)		

	*Verbena bonariensis**	2(30)	1(5)		
CLASS MAGNOLIOPSIDA (Flowering Plants)					
Subclass Liliidae (Monocotyledons)					
CYPERACEAE	*Baumea articulata*			10(200)	30(500+)
	Eleocharis equisetina				50(1000+)
	Cyperus eragrostis				2(20)
JUNCACEAE	*Juncus usitatus*			20(300+)	5(50)
	*Juncus acutus**				1(2)
LOMANDRACEAE	*Lomandra longifolia* subsp *longifolia*	2(20)	1(3)		
PHILYDRACEAE	*Philydrum lanuginosum*			5(50+)	1(3)
PHORMIACEAE	*Dianella revoluta*	1(6)	1(6)		
POACEAE	*Andropogon virginicus**	2(20)		20(200+) – edge of pond	1(3)
	*Axonopus fissifolius**	5(100+)	1(20)		
	*Cynodon dactylon**	70(100)	10(300+)	10(500+) – edge of pond	3(50+)
	Eragrostis elongata	1(3)			
	Imperata cylindrica var. *major*		1(10)		
	*Melinus repens**	2(20)			
	*Paspalum dilatatum**	1(5)	1(2)		
	*Paspalum urvillei**		1(2)		

	Poa sp. (no seedhead)	2(10)			
	Poa sp. (no seedhead – tuft looks like annua)	2(20)			
	*Setaria parviflora**	1(30)			
	Sporobolus creber	2(50)			
	Themeda australis	1(4)	2(50)		
POLYGONACEAE	*Persicaria strigosa*			1(2)	
TYPHACEAE	*Typha orientalis*			80(1000+)	

Appendix E
Biobank Credit Report

Biodiversity credit report

This report identifies the number and type of biodiversity credits required for a major project.

Date of report: 24/08/2018 Time: 9:03:12AM Calculator version: v4.0

Major Project details

Proposal ID:	0081/2017/4573MP
Proposal name:	New Maitland Hospital
Proposal address:	Metford Road Metford NSW 2323
Proponent name:	Health Infrastructure
Proponent address:	Level 14, 77 Pacific Highway North Sydney NSW 2060
Proponent phone:	02 9978 5402
Assessor name:	Isaac Mamott
Assessor address:	1/262 Sailors Bay Road Northbridge NSW 2063
Assessor phone:	9967 9505
Assessor accreditation:	0081

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	0.17	8.00
Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	4.98	149.05
Total	5.15	157

Credit profiles

1. Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter, (HU806)

Number of ecosystem credits created	80
IBRA sub-region	Hunter

Offset options - Plant Community types	Offset options - IBRA sub-regions
Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter, (HU806) Melaleuca decora low forest of the central Hunter Valley, Sydney Basin Bioregion, (HU564) Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast, (HU619) Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast, (HU802) Spotted Gum - Broad-leaved Mahogany - Grey Gum grass - shrub open forest on Coastal Lowlands of the Central Coast, (HU803) Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest, (HU804) Red Ironbark - Spotted Gum - Prickly-leaved Paperbark shrubby open forest of the Lower Hunter, (HU807) Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter, (HU814) Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter, (HU815) Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter, (HU816) Grey Box - Grey Gum - Rough-barked Apple - Blakely's Red Gum grassy open forest of the central Hunter, (HU822)	Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter, (HU806)

Number of ecosystem credits created	69
IBRA sub-region	Hunter

Offset options - Plant Community types	Offset options - IBRA sub-regions
Melaleuca decora low forest of the central Hunter Valley, Sydney Basin Bioregion, (HU564) Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast, (HU619) Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast, (HU802) Spotted Gum - Broad-leaved Mahogany - Grey Gum grass - shrub open forest on Coastal Lowlands of the Central Coast, (HU803) Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest, (HU804) Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter, (HU806) Red Ironbark - Spotted Gum - Prickly-leaved Paperbark shrubby open forest of the Lower Hunter, (HU807) Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter, (HU814) Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter, (HU815) Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter, (HU816) Grey Box - Grey Gum - Rough-barked Apple - Blakely's Red Gum grassy open forest of the central Hunter, (HU822)	Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

3. Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion, (HU673)

Number of ecosystem credits created	8
IBRA sub-region	Hunter

Offset options - Plant Community types	Offset options - IBRA sub-regions
Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion, (HU673) Cladium procerum coastal freshwater wetland, (HU949) Water Couch - Tall Spike Rush freshwater wetland of the Central Coast and lower Hunter, (HU950)	Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Summary of species credits required

Appendix F
Likelihood of Occurrence Table

APPENDIX C

Likelihood of Occurrence/Subject Species Table

Table Legend

V = Vulnerable
E = Endangered
Y = Yes
N = No
F = Foraging habitat
B = Breeding/roosting/denning habitat
R1 = recorded on HI and former CSR site GHD (2012)
R2 = recorded on HI and former CSR site by General Flora and Fauna (2014)

Scientific Name	Common Name	TSC Act	EPBC Act	total # individuals recorded; # recorded locations (within 20km Bionet search radius of subject site)	Habitat Requirements	Potential Habitat Present on Subject Site (Y/N) (F/B)	Subject Species for Current Proposal (Y/N)
Litoria aurea	Green and Golden Bell Frog	E	V	31;7	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available. The species is active by day and usually breeds in summer when conditions are warm and wet. Preyed upon by various wading birds and snakes. Not recorded on subject site or greater metford triangle remnant based on targeted searches by General Flora and Fauna (2014). General Flora and Fauna concluded that the presence of Gambusia in the man-made ponds on the subject site would likely preclude the presence of the species on the site. No updated targeted surveys for the species has been undertaken for the current proposal (the 2014 surveys are considered to be still relevant for the purposes of assessing the current proposal).	Y	N
Anseranas semipalmata	Magpie Goose	V	-	4;2	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. Man made ponds on the subject site are considered potential habitat for the species although the expansive Tenambit wetlands to the north of the site (as well as	Y	Y

					additional ephemeral and semi permanent lower Hunter River floodplain wetlands between Maitland east to Seaham and Beresfield) are expected to be more extensively used by the species on an opportunistic basis. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014).		
Oxyura australis	Blue-billed Duck	V	-	15;6	The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. It will fly if disturbed, but prefers to dive if approached. Blue-billed Ducks will feed by day far from the shore, particularly if dense cover is available in the central parts of the wetland. They feed on the bottom of swamps eating seeds, buds, stems, leaves, fruit and small aquatic insects such as the larvae of midges, caddisflies and dragonflies. Blue-billed Ducks are partly migratory, with short-distance movements between breeding swamps and overwintering lakes with some long-distance dispersal to breed during spring and early summer. Blue-billed Ducks usually nest solitarily in Cumbungi over deep water between September and February. They will also nest in trampled vegetation in Lignum, sedges or Spike-rushes, where a bowl-shaped nest is constructed. Young birds disperse in April-May from their breeding swamps in inland NSW to non-breeding areas on the Murray River system and coastal lakes. Man made ponds on the subject site are considered potential habitat for the species although the expansive Tenambit wetlands to the north of the site (as well as additional ephemeral and semi permanent lower Hunter River floodplain wetlands between Maitland east to Seaham and Beresfield) are expected to be more extensively used by the species on an opportunistic basis. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014).	Y	Y
Stictonetta naevosa	Freckled Duck	V	-	78;5	Prefers permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds. Generally rest in dense	N	N

					cover during the day, usually in deep water. Feed at dawn and dusk and at night on algae, seeds and vegetative parts of aquatic grasses and sedges and small invertebrates. Nesting usually occurs between October and December but can take place at other times when conditions are favourable. Nests are usually located in dense vegetation at or near water level. Man made ponds on the subject site are considered potential habitat for the species although the expansive Tenambit wetlands to the north of the site (as well as additional ephemeral and semi permanent lower Hunter River floodplain wetlands between Maitland east to Seaham and Beresfield) are expected to be more extensively used by the species on an opportunistic basis. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014).		
Ptilinopus regina	Rose crowned Fruit Dove	V	-	1;1	Rose-crowned Fruit-doves occur mainly in sub-tropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful. They are shy pigeons, not easy to see amongst the foliage, and are more often heard than seen. They feed entirely on fruit from vines, shrubs, large trees and palms, and are thought to be locally nomadic as they follow the ripening of fruits. Some populations are migratory in response to food availability - numbers in north-east NSW increase during spring and summer then decline in April or May. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014).	N	N
Ephippiorhynchus asiaticus	Black necked Stork	E	-	43;33	Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers are the key habitat in NSW for the Black-necked Stork. Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries. Storks usually forage in water 5-30cm deep for vertebrate and invertebrate prey. Eels regularly contribute the greatest biomass to their diet, but they feed on a wide variety of animals, including other fish, frogs and invertebrates (such as beetles, grasshoppers, crickets and crayfish). Black-necked Storks build large nests high in tall trees close to water. Trees usually provide clear observation of the surroundings and are at low elevation (reflecting the floodplain habitat).	Y	Y

					In NSW, breeding activity occurs May - January; incubation May - October; nestlings July - January; fledging from September. Man made ponds on the subject site are considered potential habitat for the species although the expansive Tenambit wetlands to the north of the site (as well as additional ephemeral and semi permanent lower Hunter River floodplain wetlands between Maitland east to Seaham and Beresfield) are expected to be more extensively used by the species on an opportunistic basis. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014).		
Ixobrychus flavicollis	Black Bittern	V	-	1;1	Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves. Feeds on frogs, reptiles, fish and invertebrates, including snails, dragonflies, shrimps and crayfish, with most feeding done at dusk and at night. During the day, roosts in trees or on the ground amongst dense reeds. Generally solitary, but occurs in pairs during the breeding season, from December to March. Like other bitterns, but unlike most herons, nesting is solitary. Nests, built in spring, are located on a branch overhanging water and consist of a bed of sticks and reeds on a base of larger sticks. Man made ponds on the subject site are considered potential habitat for the species although the expansive Tenambit wetlands to the north of the site (as well as additional ephemeral and semi permanent lower Hunter River floodplain wetlands between Maitland east to Seaham and Beresfield) are expected to be more extensively used by the species on an opportunistic basis. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014).	Y	Y
Circus assimilis	Spotted Harrier	V	-	1;1	Occurs in grassy open woodland including *Acacia* and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	N	N

					Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014).		
Haliaeetus leucogaster	White-bellied Sea-eagle	V	-	27;15	Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Occurs at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves; and at, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest). Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as 'guard roosts'. Nests are large structures built from sticks and lined with leaves or grass. Feed mainly on fish and freshwater turtles, but also waterbirds, reptiles, mammals and carrion. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014).	Y (F,B)	Y
Hamirostra melanosternon	Black breasted Buzzard	V	-	1;1	Lives in a range of inland habitats, especially along timbered watercourses which is the preferred breeding habitat. Also hunts over grasslands and sparsely timbered woodlands. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014). Preferred habitat not present on subject site.	N	N
Hieraaetus morphnoides	Little Eagle	V	-	2;2	Occupies open eucalypt forest, woodland or open woodland. Sheoak or *Acacia* woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. Lays two or three eggs during spring, and young fledge in early summer. Preys on birds, reptiles and mammals, occasionally adding large insects and carrion. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014). Potential habitat is present on subject site.	Y (F,B)	Y

Lophoictinia isura	Square tailed Kite	V	-	1;1	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. Is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage. Appears to occupy large hunting ranges of more than 100km^2. Breeding is from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014). Potential habitat is present on subject site.	Y (F,B)	Y
Pandion cristatus	Eastern Osprey	V	-	7;3	Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water. Breed from July to September in NSW. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014). Potential foraging habitat is present on subject site.	Y (F)	Y
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	9;2	In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas. Favours old growth forest and woodland attributes for nesting and roosting. Nests are located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014). Potential foraging habitat is present on subject site.	Y (F,R)	Y
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	1;1	Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (*Allocasuarina littoralis*) and Forest Sheoak (*A. torulosa*) are important foods. Dependent on large	Y (F,B)	Y

					hollow-bearing eucalypts for nest sites. A single egg is laid between March and May. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014). Limited potential foraging and breeding habitat is present on subject site.		
Glossopsitta pusilla	Little Lorikeet	V	-	45;10	Forages primarily in the canopy of open *Eucalyptus* forest and woodland, yet also finds food in *Angophora, Melaleuca* and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species. Feeds mostly on nectar and pollen, occasionally on native fruits such as mistletoe, and only rarely in orchards. Gregarious, travelling and feeding in small flocks (<10), though often with other lorikeets. Roosts in treetops, often distant from feeding areas. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Recorded by General Flora and Fauna (2014) within the south-western LHSGIF remnant on Lot 7314.	Y (F.B)	Y
Lathamus discolour	Swift Parrot	E	CE	1;1	Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. Migrates to the Australian south-east mainland between March and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Inland Grey Box *E. microcarpa*, Grey Box *E. moluccana* and Blackbutt *E. pilularis*. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014). Potential overwintering foraging habitat is present on subject site (Spotted Gum is a co-dominant canopy species).	Y(F)	Y

Neophema pulchella	Turquoise Parrot	V	-	9;3	Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Usually seen in pairs or small, possibly family, groups and have also been reported in flocks of up to thirty individuals. Prefers to feed in the shade of a tree and spends most of the day on the ground searching for the seeds or grasses and herbaceous plants, or browsing on vegetable matter. Forages quietly and may be quite tolerant of disturbance. However, if flushed it will fly to a nearby tree and then return to the ground to browse as soon as the danger has passed. Nests in tree hollows, logs or posts, from August to December. It lays four or five white, rounded eggs on a nest of decayed wood dust. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014). Potential marginal foraging and breeding habitat is present on subject site.	Y(F,B)	Y
Ninox connivens	Barking Owl	V	-	3;3	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey on these fertile soils. Roost in shaded portions of tree canopies, including tall midstorey trees with dense foliage (eg. *Acacia* and *Casuarina* species). During nesting season, the male perches in a nearby tree overlooking the hollow entrance. Preferentially hunts small arboreal mammals such as Squirrel Gliders and Ringtail Possums, but when loss of tree hollows decreases these prey populations the owl becomes more reliant on birds, invertebrates and terrestrial mammals such as rodents and rabbits. Can catch bats and moths on the wing, but typically hunts by sallying from a tall perch. Requires very large permanent territories in most habitats due to sparse prey densities. Monogamous pairs hunt over as much as 6000 hectares, with 2000 hectares being more typical in NSW habitats. Two or three eggs are laid in hollows of large, old trees. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014). Potential foraging and breeding habitat is present on subject site.	Y(F,B)	Y

Ninox strenua	Powerful Owl	V	-	11;11	The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine *Syncarpia glomulifera*, Black She-oak *Allocasuarina littoralis*, Blackwood *Acacia melanoxylon*, Rough-barked Apple *Angophora floribunda*, Cherry Ballart *Exocarpus cupressiformis* and a number of eucalypt species. The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. Pairs of Powerful Owls demonstrate high fidelity to a large territory, the size of which varies with habitat quality and thus prey densities. In good habitats a mere 400 can support a pair; where hollow trees and prey have been depleted the owls need up to 4000 ha. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. While the female and young are in the nest hollow the male Powerful Owl roosts nearby (10-200 m) guarding them, often choosing a dense "grove" of trees that provide concealment from other birds that harass him. Powerful Owls are monogamous and mate for life. Nesting occurs from late autumn to mid-winter. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014). Potential foraging habitat is present on subject site.	Y (F)	Y
Tyto novaehollandiae	Masked Owl	V	-	9;9	Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to 1000 hectares. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014). Potential foraging habitat is present on subject site.	Y (F)	Y
Tyto tenebricosa	Sooty Owl	V	-	1;1	Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist	N	N

					eucalypt forests. Roosts by day in the hollow of a tall forest tree or in heavy vegetation; hunts by night for small ground mammals or tree-dwelling mammals such as the Common Ringtail Possum (*Pseudocheirus peregrinus*) or Sugar Glider (*Petaurus breviceps*). Nests in very large tree-hollows. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014). Potential foraging habitat is present on subject site.		
Chthonicola sagittata	Speckled Warbler	V	-	5;6	The Speckled Warbler lives in a wide range of *Eucalyptus* dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. The diet consists of seeds and insects, with most foraging taking place on the ground around tussocks and under bushes and trees. Pairs are sedentary and occupy a breeding territory of about ten hectares, with a slightly larger home-range when not breeding. The rounded, domed, roughly built nest of dry grass and strips of bark is located in a slight hollow in the ground or the base of a low dense plant, often among fallen branches and other litter. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014). Prefers lightly wooded gullies which are not present on subject site. Low likelihood of occurrence based on absence of preferred habitat.	N	N
Melithreptus gularis gularis	Black chinned Honeyeater (eastern subspecies)	V	-	3;3	In NSW it is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond and Clarence River areas. It has also been recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions, though it is very rare in the latter. Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) and Forest Red Gum (*E. tereticornis*). Also inhabits open forests of smooth-barked gums,	N	N

					stringybarks, ironbarks, river she-oaks (nesting habitat) and tea-trees. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014). Low likelihood of occurrence based on absence of preferred habitat.		
Pomatostomus temporalis temporalis	Grey crowned Babbler (eastern subspecies)	V	-	170;56	In NSW, the eastern sub-species occurs on the western slopes of the Great Dividing Range, and on the western plains reaching as far as Louth and Balranald. It also occurs in woodlands in the Hunter Valley and in several locations on the north coast of NSW. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Woodlands on fertile soils in coastal regions. Build and maintain several conspicuous, dome-shaped stick nests about the size of a football. A nest is used as a dormitory for roosting each night. Nests are usually located in shrubs or sapling eucalypts, although they may be built in the outermost leaves of low branches of large eucalypts. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014). Potential foraging and breeding habitat is present on subject site.	Y(F,B)	Y
Daphoenositta chrysoptera	Varied Sittella	V	-	25;12	Inhabits eucalypt forests and woodlands, especially those containing 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 small branches and twigs in the tree canopy. Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014). Potential foraging and breeding habitat is present on subject site.	Y (F,B)	Y
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	5;5	Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. It has also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest. Also found in farmland, usually at the edges of forest or woodland. Nest is an open, cup-shape, made of twigs, grass, fibrous rootlets and occasionally casuarina needles, and may be lined with	Y (F)	Y

					grass, rootlets or infrequently horsehair, occasionally unlined. Nest sites vary greatly, but generally occur in shrubs or low trees, living or dead, horizontal or upright forks in branches, spouts, hollow stumps or logs, behind loose bark or in a hollow in the top of a wooden fence post. Most breeding activity occurs on the western slopes of the Great Dividing Range. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014). Potential foraging habitat is present on subject site.		
Petroica boodang	Scarlet Robin	V	-	3;3	The Scarlet Robin is primarily a resident in forests and woodlands, but some adults and young birds disperse to more open habitats after breeding. In autumn and winter many Scarlet Robins live in open grassy woodlands, and grasslands or grazed paddocks with scattered trees. Birds forage from low perches, fence-posts or on the ground, from where they pounce on small insects and other invertebrates which are taken from the ground, or off tree trunks and logs; they sometimes forage in the shrub or canopy layer. Scarlet Robin pairs defend a breeding territory and mainly breed between the months of July and January; they may raise two or three broods in each season. This species' nest is an open cup made of plant fibres and cobwebs and is built in the fork of tree usually more than 2 metres above the ground; nests are often found in a dead branch in a live tree, or in a dead tree or shrub. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014). Potential foraging and breeding habitat is present on subject site.	Y (F,B)	Y
Dasyurus maculatus	Spotted-tailed Quoll	V	E	2;2	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites. Mostly nocturnal, although will hunt during the day; spends most of the time on the ground, although also an excellent climber and will hunt possums and gliders in tree hollows and prey on roosting birds. Use communal 'latrine sites', often on flat rocks among boulder fields, rocky cliff-faces or along rocky stream beds or banks. A generalist predator with a preference for medium-sized mammals. Consumes a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits, reptiles and insects. Also eats carrion and takes domestic fowl. Females occupy home	Y (F,B)	Y

					ranges up to about 750 hectares and males up to 3500 hectares. Are known to traverse their home ranges along densely vegetated creeklines. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014). Potential foraging and breeding habitat is present on subject site.		
Phascolarctos cinereus	Koala	V	V	10;10	Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Inactive for most of the day, feeding and moving mostly at night. Spend most of their time in trees, but will descend and traverse open ground to move between trees. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size. Generally solitary, but have complex social hierarchies based on a dominant male with a territory overlapping several females and sub-ordinate males on the periphery. Females breed at two years of age and produce one young per year. Not recorded in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014). Potential limited foraging habitat is present on subject site. No known Koala populations in the lower Hunter valley.	Y (F, B) – potential feed trees onsite include planted *E.tereticornis* and possibly *E.punctata* x *E.canaliculata*	N
Petaurus norfolcensis	Squirrel Glider	V	-	63;53	Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and a variety of coastal forest vegetation types. Prefers mixed species stands with a shrub or Acacia midstorey. Lives in family groups of a single adult male one or more adult females and offspring. Requires abundant tree hollows for refuge and nest sites. Diet varies seasonally and consists of *Acacia* gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein. Recorded by General Flora and Fauna (2014) in the south-western LHSGIF remnant on Lot 7314.	Y (R2,F,B)	Y
Phascogale tapoatafa	Brush-tailed Phascogale	V	-	6;12	Prefers dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest. Agile climber foraging preferentially in rough barked trees of 25 cm DBH or greater. Feeds mostly on arthropods but will also eat other invertebrates, nectar and sometimes small vertebrates.	Y (F,B)	Y

					Females have exclusive territories of approximately 20 - 40 ha, while males have overlapping territories often greater than 100 ha. Nest and shelter in tree hollows with entrances 2.5 - 4 cm wide and use many different hollows over a short time span. Mating occurs May - July; males die soon after the mating season whereas females can live for up to three years but generally only produce one litter.		
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	1624;45	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. Can travel up to 50 km from the camp to forage; commuting distances are more often <20 km. Feed on the nectar and pollen of native trees, in particular *Eucalyptus, Melaleuca* and *Banksia*, and fruits of rainforest trees and vines. Also forages in cultivated gardens and fruit crops. Recorded by General Flora and Fauna (2014) just outside the south-eastern corner of the greater metford triangle. Potential foraging habitat for the species occurs (LHSGIF habitat) within Lot 7314. Species was also recorded by GHD (2012) flying over the greater metford triangle site.	Y (R2,F)	Y
Saccolaimus flaviventris	Yellow bellied Sheathtail-bat	V	-	8;8	Roosts singly or in groups of up to six, in tree hollows and buildings. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. Breeding has been recorded from December to mid-March, when a single young is born. Seasonal movements are unknown; there is speculation about a migration to southern Australia in late summer and autumn. Not recorded on Lot 7314 or in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014). Potential foraging and roosting habitat is present on subject site.	Y(F,B)	Y
Mormopterus norfolkensis	Eastern Freetail-bat	V	-	70;70	Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roosts mainly in tree hollows but will also roost under	Y (F,B)	Y

					bark or in man-made structures. Usually solitary but also recorded roosting communally, probably insectivorous. Not recorded on Lot 7314 or in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014). Potential foraging and roosting habitat is present on subject site.		
Chalinolobus dwyeri	Large eared Pied Bat	V	V	6;6	Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. They remain loyal to the same cave over many years. Found in well-timbered areas containing gullies. This species probably forages for small, flying insects below the forest canopy. Likely to hibernate through the coolest months. It is uncertain whether mating occurs early in winter or in spring. Not recorded on Lot 7314 or in the greater metford triangle by GHD (2012) nor General Flora and Fauna (2014). Preferred foraging and roosting habitat is not present on subject site.	N	N
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	31;31	Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. Hunts beetles, moths, weevils and other flying insects above or just below the tree canopy. Hibernates in winter. Females are pregnant in late spring to early summer. Possible recording by GHD (2012) on the greater metford triangle site (no precise location record available). GHD (2012) noted the record comprised a 'Species Group' record which may have been a recorded call from the Greater Broad nosed Bat and Eastern Broad nosed bat. The call was not strong enough to make a confident determination amongst the 3 species in this group.	Y (R1,F,B)	Y
Miniopterus australis	Little Bent-wing Bat	V	-	101;101	Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater	Y(R1,R2,F,B)	Y

					drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. They often share roosting sites with the Common Bentwing-bat and, in winter, the two species may form mixed clusters. In NSW the largest maternity colony is in close association with a large maternity colony of Eastern Bentwing-bats (*Miniopterus schreibersii*) and appears to depend on the large colony to provide the high temperatures needed to rear its young. Maternity colonies form in spring and birthing occurs in early summer. Males and juveniles disperse in summer. Only five nursery sites /maternity colonies are known in Australia. The species was recorded by GHD (2012) on the greater metford triangle site (no precise location given) and by General Flora and Fauna (2014) in Hunter Lowland Redgum Woodland to the east of Lot 7314 on the greater metford triangle site just south of the northern boundary line.		
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	59;59	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes. At other times of the year, populations disperse within about 300 km range of maternity caves. Cold caves are used for hibernation in southern Australia. Breeding or roosting colonies can number from 100 to 150,000 individuals. Hunts in forested areas, catching moths and other flying insects above the tree tops. Recorded by General Flora and Fauna (2014) foraging over man made ponds just outside Lot 7314 and in the far south-eastern corner of the greater metford triangle in LHSGIF habitat. Also included as a 'Species Group' record (with *Vespadelus sp*.) by GHD (2012).	Y (R1,R2,F)	Y
Myotis macropus	Southern Myotis	V	-	75;30	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.	Y(R2,F,B)	Y

					Recorded by General Flora and Fauna (2014) foraging over man made ponds just outside Lot 7314.		
Vespadelus troughtoni	Eastern Cave Bat	V	-	19;19	Very little is known about the biology of this uncommon species. A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Occasionally found along cliff-lines in wet eucalypt forest and rainforest. Little is understood of its feeding or breeding requirements or behaviour. Possible recording by GHD (2012) on the greater metford triangle site (no precise location record available). GHD (2012) noted the record comprised a 'Species Group' record which may have been a recorded call from the Little Forest Bat and Eastern Forest Bat. The call was not strong enough to make a confident determination amongst the 3 species in this 'group'.	Y(R1,F)	Y
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	9;9	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species. Little is known of its reproductive cycle, however a single young is born in January; prior to birth, females congregate at maternity sites located in suitable trees, where they appear to exclude males during the birth and raising of the single young. Recorded by General Flora and Fauna (2014) foraging over man made ponds just outside Lot 7314 and in the far south-eastern corner of the greater metford triangle in LHSGIF habitat. Also included as a 'Species Group' record with the Eastern Broad nosed Bat and Eastern False Pipistrelle by GHD (2012).	Y (R1,R2,F)	Y
Pseudomys novaehollandiae	New Holland Mouse	-	V	5;5	Known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes. It is a social animal, living predominantly in burrows shared with other individuals. Distribution is patchy in time and space, with peaks in abundance	N	N

					during early to mid stages of vegetation succession typically induced by fire. Not recorded by GHD (2012) nor General Flora and Fauna (2014). Preferred habitat not present on subject site.		
Tetratheca juncea	Black-eyed Susan	V	V	299;18	The majority of populations occur on low nutrient soils associated with the Awaba Soil Landscape. While some studies show the species has a preference for cooler southerly aspects, it has been found on slopes with a variety of aspects. It generally prefers well-drained sites below 200m elevation and annual rainfall between 1000 - 1200mm. The preferred substrates are sandy skeletal soil on sandstone, sandy-loam soils, low nutrients; and clayey soil from conglomerates, pH neutral. It usually spreads via underground stems which can be up to 50 cm long. Consequently, individual plants may be difficult to identify. It also reproduces sexually but this requires insect pollination. Large populations of this species are particularly important. Not recorded on the greater metford triangle by General Flora and Fauna (2014).	Y (possible but low likelihood given absence of preferred habitats)	N
Acacia bynoeana	Bynoe's Wattle	E	V	44;19	Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple. The author has recorded this species along transmission line easements and tracks/roadsides, rarely in intact interior forested habitats. Not recorded by GHD (2012) nor by General Flora and Fauna (2014). Preferred habitats not present on subject site.	Y (possible but low likelihood given absence of preferred habitats)	N
Maundia triglochinoides		V	-	3;3	Grows in swamps, lagoons, dams, channels, creeks or shallow freshwater wetlands 30 - 60 cm deep on heavy clay, low nutrients. Flowering occurs during warmer months. Associated with wetland species e.g. *Triglochin procerum*. Probably wind pollinated. Diaspore is the seed and root tubers, which are probably dispersed by water. Spreads vegetatively, with tufts of leaves arising along rhizome. Populations expand following flood events and	N	N

					contract to more permanent wetlands in times of low rainfall. Flowers November-January. Not recorded onsite by GHD (2012) nor General Flora and Fauna (2014).		
Callistemon linearifolius	Netted Bottle brush	V	-	108;13	Grows in dry sclerophyll forest on the coast and adjacent ranges. Flowers spring – summer. The author has typically recorded this species in swamp forest habitats on the lower North Coast. Not recorded onsite by GHD (2012) nor General Flora and Fauna (2014). Preferred habitats not present on subject site.	N	N
Eucalyptus glaucina	Slaty Red Gum	V	V	1;1	Grows in grassy woodland and dry eucalypt forest. Grows on deep, moderately fertile and well-watered soils. The author has recorded this species in floodplain/swamp habitats with which it is strongly associated with. Not recorded onsite by GHD (2012) nor General Flora and Fauna (2014). Preferred habitats not present on subject site.	N	N
Eucalyptus parramattensis subsp decadens	-	V	V	1034;167	There are two separate meta-populations of *E. parramattensis* subsp. *decadens*. The Kurri Kurri meta-population is bordered by Cessnock—Kurri Kurri in the north and Mulbring—Abedare in the south. Large aggregations of the subspecies are located in the Tomalpin area. The Tomago Sandbeds meta-population is bounded by Salt Ash and Tanilba Bay in the north and Williamtown and Tomago in the south. Generally occupies deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high. It occurs in dry sclerophyll woodland with dry heath understorey. It also occurs as an emergent in dry or wet heathland. Often where this species occurs, it is a community dominant. Not recorded onsite by GHD (2012) nor General Flora and Fauna (2014). Preferred habitats not present on subject site.	N	N
Rutidosus heterogama	-	V	V	-	Grows in heath on sandy soils, and has been recorded along disturbed roadsides. Hunter population centered on Cessnock-Kurry Kurri area. Not recorded onsite by GHD (2012) nor General Flora and Fauna (2014). Preferred habitats not present on	N	N

					subject site. Author is not aware of any known populations of the species in the Maitland/Metford locality.		
Syzygium paniculatum	Magenta Lilly Pilly	E	V	1;1	On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities. A commonly planted species. Not recorded onsite by GHD (2012) nor General Flora and Fauna (2014). Preferred habitats not present on subject site.	N	N
Grevillea parviflora subsp parviflora	Small flower Grevillea	V	V	2108; 44	Grows in sandy or light clay soils usually over thin shales, often with lateritic ironstone gravels and nodules. Sydney region occurrences are usually on Tertiary sands and alluvium, and soils derived from the Mittagong Formation. Soil landscapes include Lucas Heights or Berkshire Park. Occurs in a range of vegetation types from heath and shrubby woodland to open forest. In Sydney it has been recorded from Shale Sandstone Transition Forest and in the Hunter in Kurri Sand Swamp Woodland. however, other communities occupied include *Corymbia maculata - Angophora costata* open forest in the Dooralong area, in Sydney Sandstone Ridgetop Woodland at Wedderburn and in Cooks River / Castlereagh Ironbark Forest at Kemps Creek. Not recorded onsite by GHD (2012) nor General Flora and Fauna (2014) nor by **pitt&sherry** as part of the July 2017 biobank assessment.	Y	N

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