



**Northern Beaches Health Service Redevelopment**  
*A new wave in healthcare*

Northern Beaches Hospital

*Stage 1: Concept Design, Site Clearance & Preparatory Works*

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## Appendix D

Biodiversity Offset Strategy



# Northern Beaches Hospital Biodiversity Offset Strategy

Prepared for Health Infrastructure

Date | 20 September 2013



**SMEC**

**ENVIRONMENT**

## Document Controls

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## Executive Summary

The Northern Beaches Health Service Redevelopment project has been identified as a key State Government priority. A key outcome of the project is the development of a new Northern Beaches Hospital at Frenchs Forest.

Ecological surveys of the hospital site at Frenchs Forest confirmed the presence of Duffys Forest Ecological Community (DFEC), an endangered ecological community, on the site. The surveys also identified that the site was likely used as foraging habitat by the Powerful Owl which is a listed threatened species under NSW legislation.

The Biobanking Assessment Methodology (BBAM) has been used to assess the anticipated impacts of the hospital development on native vegetation and biodiversity. This has been undertaken with reference to the Office of Environment and Heritage (OEH) *Interim policy on assessing and offsetting biodiversity impacts of Part 3A, State significant development (SSD) and State significant infrastructure (SSI) projects* provided to HI by OEH on 21 March 2013. The interim policy provides for a three tiered approach to mitigation of impacts on listed threatened species and ecological communities.

This report provides a detailed consideration of each of the tiers under the interim policy and provides justification as to why the Tier 1 and the Tier 2 pathways are not considered practicable options for the hospital development. The preferred offset strategy is based on the Tier 3 pathway. This identifies a registered Biobank site at Belrose as a suitable offset which is considered a suitable and sufficient offset with reference to the various criteria set down in the interim policy.





# I Background

## I.1 Background to the proposal

The Northern Beaches Hospital is part of the Northern Beaches Health Service Redevelopment project. This project is intended to create a new health precinct as part of a sustainable health system that would provide improved locally accessible health services, employment opportunities, and would promote a culture of innovation across all health services.

The project has three key outcomes:

1. Development of a new Northern Beaches Hospital at Frenchs Forest, combining public and private health care delivery so the Northern Beaches community has improved access and choices with regard to quality and sustainable health care.
1. Redesign of community health services on the Northern Beaches, with a new Northern Community Health Centre at Mona Vale, a new Southern Community Health Centre at Brookvale, and enhanced child and family specialist services at Dalwood in Seaforth.
2. Redevelopment of Mona Vale Hospital and closure of Manly Hospital to bring together acute health services onto one site, creating the opportunity to expand contemporary models of care, increase clinical collaboration, provide a broader range of professional opportunities, and implement sustainable service delivery.

Delivery of the project is being managed by NSW Health Infrastructure (HI). HI is a public authority responsible for the delivery and management of major capital works projects on behalf of the NSW Ministry of Health.

The need for the hospital is being driven by a range of factors including the following:

- Manly and Mona Vale hospitals are among the smallest hospitals in metropolitan NSW by throughput, and struggle in their ability to staff and provide the range of services required by an area such as the Northern Beaches.
- The current fragmentation of services and the unavailability of particular specialist services at Manly or Mona Vale hospitals means that in many instances patients and carers are required to travel between the two hospitals to access the services they need and in some cases also travel to the Royal North Shore Hospital to access specialist treatment.
- Community health services are spread across a number of small facilities that are not well designed for the work they do. The growth in chronic disease requires investment in community health services that can work together with primary care to meet the needs of our ageing population while reducing the need to admit to a hospital bed.
- Both existing hospitals suffer from ageing facilities that are not well configured to provide contemporary health care models. A new hospital will enable health care providers to deliver contemporary and future models of care and with the infrastructure flexibility to adapt to changing demands and care models trends.
- Existing health facilities are not well located in relation to the Northern Beaches catchment. While there is a trade-off between access and range of services provided, a single, centrally-located hospital would enable provision of a wider range of services of higher role delineation, reducing the need for patients to travel outside the Northern Beaches. This central location

would also reduce pressures on Royal North Shore Hospital by redirecting demand for non-tertiary care.

The Northern Beaches Hospital has been identified as a key State Government priority in a number of strategy documents including:

- The NSW State Infrastructure Strategy 2012 – 2032 (State Infrastructure Strategy)
- The North East Subregional Strategy
- The *Metropolitan Plan for Sydney 2036* (draft Metropolitan Strategy).

## **1.2 Objectives of the proposal**

The key objectives of the overall development of the Northern Beaches Hospital are as follows:

- Support the delivery of contemporary health services to the population of the Northern Beaches now and into the future
- Address urgent infrastructure and operational inefficiencies at the existing Mona Vale, Manly and community health facilities
- Enhance coordination and provision of multi-disciplinary health services locally
- Support contemporary, evidence based practice across all services, improving quality, safety, efficiency and effectiveness
- Deliver new health infrastructure that would provide a critical mass of services to address current and ongoing workforce challenges of recruitment and retention as well as providing enhanced training and professional development opportunities
- Extend access to an integrated service network that is patient-centred and culturally appropriate
- Improve regional capacity and health infrastructure to improve access to health care for the residents on the Northern Beaches

In addition to the above objectives, the proposal would support the NSW Government agenda to initiate proactively planned 'health care precincts' with easy access to related private and public health services delivered by both government and non-government providers. The NSW Government is actively pursuing a range of options for working with the private sector with the aim to deliver better services at lower cost and with greater innovation.

## **1.3 Overview of the proposal**

The Northern Beaches Hospital is being undertaken as a staged SSI development as follows.

### *Stage 1*

- Concept proposal; and
- Site clearance and preparatory works generally comprising:
  - Establishment of site office, including temporary connection to services (water, sewer, power);
  - Closure of Bantry Bay Road to the public and establishment of construction traffic management controls;

- Removal of existing temporary fencing and installation of construction fencing;
- General clearance of site vegetation including tree stumps, but with retention of the area of vegetation broadly consistent with the former Blinking Light Reserve at the eastern end of the site;
- Thinning of the understorey in the aforementioned area of vegetation;
- 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 to green waste recycling facility or other beneficial reuse;
- Removal of foundations, concrete pads, etc associated with former buildings and subsequent disposal of these materials to an appropriate receiving facility;
- Site stabilisation (such as establishment of erosion and sediment controls) in preparation for Stage 2; and
- Site management in the period between completion of the site clearance and preparatory works, and commencement of Stage 2.

## Stage 2

- Main construction works that may include:
  - Bulk excavation works, including a sub-level structure for a loading dock and limited car parking;
  - Construction of the new hospital;
  - Utility and services amplifications works;
  - Any additional car parking for staff, patients and visitors; and
  - External site works such as landscaping, pathways, etc.
- Hospital commissioning and operation.

Services provided would include emergency, critical care, operating theatres, acute in-patient (overnight, day, and extended day only), maternity and neonatal, paediatrics and adolescents, mental health and drug and alcohol, sub-acute, primary health care, ambulatory, clinical support, other support, and associated administrative and front of house services. The hospital would cater for both public and private patients.

Subject to obtaining all necessary planning approvals, construction is planned to commence in the first quarter of 2015.





## 2 Supporting investigations

### 2.1 Ecological surveys

HI commissioned SMEC Australia (SMEC) to undertake seasonal ecological surveys across the proposed Northern Beaches Hospital site.

Flora surveys were undertaken at the site by SMEC and Teresa James (2013) in accordance with the Biobanking Assessment Methodology (BBAM) and fauna survey by SMEC. Field survey methods were developed in close consultation with OEH to include additional requirements on threatened species assessment and survey methods, including invitation for OEH representatives to join SMEC during spring surveys in 2013. Table 1 briefly summarises the survey effort undertaken.

**Table 1 Summary of ecological survey details for the Northern Beaches Hospital Precinct**

Report	Dates of Survey	Study area	Survey details
SMEC 2012	June 2012	Hospital site	Flora - Three plots/transects (50m) were sampled in the main vegetation zones. Fauna - Stratified sampling using arboreal traps, cage traps and pitfall traps
SMEC 2012	October 2012	Hospital site	Flora - Nine plots/transects (50m) surveyed with full floristic data recorded in 20 m x 20 m plots to assist in community identification. Fauna - Stratified sampling using arboreal traps, cage traps and pitfall traps
James (2013a)	December 2012	Hospital site and adjoining areas	Field check of vegetation communities and condition – peer review.
SMEC 2013	March 2013	Hospital site	Fauna - Stratified sampling using arboreal traps, cage traps and pitfall traps
James (2013b) BioBanking report	May 2013	Hospital site & part of Brick Pit Reserve south of Warringah Road	Provisional vegetation zones checked; two additional plots/transects (50m) were sampled.

Full details of surveys and analysis carried out during 2012 and 2013 are provided in Appendix C and Appendix D respectively.

#### *Vegetation and threatened species*

The area has a high biodiversity value with potential habitat for threatened species and ecological communities. The Northern Beaches Hospital Precinct forms part of a vegetated corridor linking Oxford Falls to the north to Manly and foreshores of Middle Harbour to the south of the site. A large portion of this site contains intact vegetation identified as Duffys Forest EC (Smith and Smith 2000) which is listed under the *Threatened Species Conservation Act 1995* (TSC Act).

There is one vegetation type present on the site that is equivalent to DFEC, Red Bloodwood-Smooth-barked Apple Shrubby Forest on Shale or Ironstone (ME039).

Plot and transect data used in the assessment are provided in Appendix D. This work was undertaken by Dr Liz Broese (SMEC) and Teresa James (Teresa James Flora Consultant), both of whom are OEH-accredited biobanking assessors.

#### *Vegetation zones and condition*

The NBH site contains a complex mosaic of variable quality DFEC and highly disturbed areas. Four vegetation zones are identified as shown in Figure 1.

A worst case scenario has been adopted with regards to the potential removal of DFEC vegetation on the site. Primarily this assumes that ultimately all of areas A, B, the western half of Area C would be developed to accommodate hospital buildings and transmission infrastructure, although in practice development of the site would likely be staged. Accordingly, a worst case removal of DFEC on the site has been adopted because final design of the hospital footprint and therefore removal of vegetation has not been finalised. Figure 2 shows the assumed worst case for DFEC removal.

#### *Threatened species*

No threatened flora species were recorded in the surveys undertaken and no records are previously known from the site although a large number have been recorded within a 10 kilometre radius. The species most likely to occur was Caley's Grevillea (*Grevillea caleyi*) for which targeted survey was undertaken following OEH advice on threatened flora survey requirements.

Two threatened fauna species were detected on the hospital site during fauna surveys: Grey-headed Flying-fox (*Pteropus poliocephalus*) and Powerful Owl (*Ninox strenua*). The Powerful Owl was detected during call playback and is listed as vulnerable under the TSC Act. The site and surrounding area contains roosting trees suitable for this species, and abundant availability of prey resources. This species has an extensive foraging area and it is highly unlikely the project would have an impact.

The Grey-headed Flying-fox is listed as vulnerable under both the TSC Act and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Several Grey-headed Flying-fox were detected flying over the site during nocturnal surveys. However as the site does not contain suitable breeding and roosting resources, and the species has an extensive foraging range, it is unlikely the project would have an impact. Therefore the species was not considered for offsetting or mitigation.

## **2.2 Biobanking assessment**

#### *Credit calculations*

Field data and GIS mapping areas were entered into the biobanking credit calculator (version 2) to determine the number of credits required to offset the vegetation removal for the hospital site. All vegetation affected is identified as a 'red flag' because of its EEC status.

Ecosystem credits calculated for the total potential area of DFEC removal are presented in Table 2 and Appendix D. Species credits are provided in Table 3 and Appendix D.

**Table 2 Ecosystem credits required for removal of all DFEC associated with Northern Beaches Hospital**

<b>Vegetation Zone (Moderate/good)*</b>	<b>Area (ha) developed</b>	<b>Surrounding vegetation cover class in which the vegetation must be obtained</b>	<b>Minimum area of contiguous vegetation in which credits must be obtained</b>	<b>Ecosystem Credits required</b>
1 High	1.58	>30%	>100ha	118
2 Other	1.50	>30%	>100ha	87
3 Poor	1.15	>30%	>100ha	74
4 Medium	0.49	>30%	>100ha	32
Transmission line – zone 1 High	0.20	>30%	>100ha	5
Transmission line – zone 3 Poor	0.03	>30%	>100ha	1
<b>Total</b>				<b>317</b>

\* all zones are classified as moderate/good under BBAM due to representation of canopy species. A further category has been given for each zone based on condition and disturbance of other components of the zone.

**Table 3 Threatened species credits required for Northern Beaches Hospital**

<b>Development proposal</b>	<b>Threatened species affected</b>	<b>Extent of impact (ha)</b>	<b>Number of species credits required</b>
Hospital site	Powerful Owl	4	121
Hospital site	Grey-headed Flying-fox	Not required	Not required





### 3 Consideration of OEH interim policy

In developing the proposed biodiversity offset strategy for the Northern Beaches Hospital site, consideration has been given to the *NSW OEH interim policy on assessing and offsetting biodiversity impacts of Part 3A, State significant development (SSD) and State significant infrastructure (SSI) projects* (Appendix A), and in particular, to whether it is possible to achieve an outcome consistent with (in order of preference) Tier 1, Tier 2, or Tier 3 as set out in the interim policy. The interim policy was provided to HI by OEH on 21 March 2013.

#### 3.1 Tier 1 pathway

The Tier 1 pathway sets out an 'Improve or Maintain' standard where

*red flag assets are protected and clearing only occurs within the variation rules set out in the BBAM, and the offsetting requirement calculated by the credit calculator is met.*

The proposal does not meet the Tier 1 standard because red flag assets are to be cleared outside the rules allowed by the BBAM.

Clearing outside the rules allowed by the BBAM is necessary because:

- The entire site would potentially be utilised by the Northern Beaches Hospital development so options to avoid impacts on red flag areas on the site, such as considering different configurations of the development footprint, are not considered practicable
- The viability of biodiversity values on the red flag areas on the site would not be considered low or not viable.

The proposal also does not meet the Tier 1 'Improve or Maintain' standard because the amount and type of offsetting proposed does not meet the requirements of the BBAM credit calculator. This is because the type and quantity of credits required as per the credit calculator are not currently available on the market.

The policy acknowledges the possibility of this scenario by providing

*for a range of mechanisms to be used to implement offsets (ie not only biobanking credits) in view of the currently limited supply of biodiversity credits on the market.*

The tiered approach to offsetting outlined in the policy is intended to provide flexibility for decision makers

*who have to balance the relative environmental, social and economic merits of development proposals.*

The proposal is clearly unable to meet the Tier 1 'Improve or Maintain' standard so the next step is to consider a possible 'No Net Loss' outcome via the Tier 2 pathway.

#### 3.2 Tier 2 pathway

The Tier 2 pathway sets out a 'No Net Loss' standard where

*some/all red flag assets are not protected and clearing is allowed outside the variation rules permitted by the BBAM, but all impacts are to be fully offset in accordance with the offsetting requirements calculated by the credit calculator.*

The proposal does not meet the Tier 2 standard because although red flag assets are able to be cleared outside the rules allowed by the BBAM, the amount and type of offsetting proposed does not meet the requirements of the BBAM credit calculator. As described in relation to the consideration of the Tier 1 approach, the type and quantity of credits required as per the credit calculator are not currently available on the market.

Due to the unavailability of suitable credits on the market, the proposal is unable to meet the Tier 2 'No Net Loss' standard, so the only suitable outcome under the circumstances is to consider a 'Mitigated Net Loss' outcome via the Tier 3 pathway.

### 3.3 Tier 3 pathway

The Tier 3 pathway of 'Mitigated Net Loss' is considered the most appropriate outcome for the proposal. 'Mitigated Net Loss' occurs when

*red flag assets are to be cleared and this clearing is considered acceptable under the requirements set out for no net loss; and the amount and type of offsetting proposed is inconsistent with the requirements of the BBAM credit calculator.*

The policy states that

*In considering whether the mitigated net loss standard is appropriate, consideration should be given to:*

- whether the credits required by the calculator are available on the market;
- whether alternative offset sites (other than credits) are available on the market;
- the overall cost of the offsets and whether these costs are reasonable given the circumstances.

The policy also states that

*Should any of these circumstances apply, then it is reasonable to apply the variation criteria to the point that:*

- suitable offset sites can be found within a reasonable timeframe;
- the costs of offsetting is brought within a reasonable range; and
- an offset to clearing ratio of at least 2:1 vegetated to cleared hectares is achieved.

The mitigated net loss standard is considered appropriate in this case because:

- No other suitable credits required by the calculator are available on the market
- HI is unaware of any readily available alternative offset sites on the market
- The cost of the proposed offset strategy is considered to be at the higher end of market average price per credit
- The proposed offset strategy would secure a suitable offset within a reasonable timeframe
- The proposed offset would achieve an offset to clearing ratio of 2:1 vegetated to cleared hectares.

With a view to achieving a 'Mitigated Net Loss' outcome, consideration has also been given to the application of the variation criteria for mitigated net loss as set out in Attachment B to the policy.

The policy states that

*to achieve Tier 3 - mitigated net loss standard, the following variation criteria may be applied to the offsetting requirements of the BBAM and that the minimum area standard is an offset to clearing ratio of 2:1.*

Table 4 outlines how the variation criteria have been addressed to date in relation to this proposal.

**Table 4 Consideration of variation criteria in relation to proposed offset strategy**

Variation criteria	When is this option appropriate	How	Consideration in relation to NBH proposal
a) Convert ecosystem credits for one vegetation type to any vegetation type within the same vegetation formation in the same IBRA bioregion	When no matching ecosystem credits are available	Review to biometric vegetation database to identify vegetation types in the same formation in the same IBRA bioregion. Number of credits should be the same.	The proposed offset strategy partially meets the variation criteria for vegetation formation.
b) Convert one type of species credit to another type of species credit with the same or more endangered conservation status	When species credit is not available and the matching species credit is considered a greater conservation priority.	Review conservation status of species Number of credits should be the same	The Belrose site has species credits of greater conservation priority but a shortfall in number of credits. The remainder of species credits could be waived in accordance with variation criterion e).
c) Remove/reduce the need for offsetting	Where clearing is minimal (less 4 ha) and where the vegetation is not a highly cleared vegetation type or a Commonwealth or State listed TEC.	Identify and remove credits required for offsetting vegetation under 4ha and for vegetation types that aren't greater than 70% cleared or a Commonwealth or State listed TEC	N/A – clearing is >4ha, State listed TEC.
d) Convert ecosystem credits required to hectares and, if necessary, convert hectare figure to an estimate of land value	Where suitable offset sites are known to exist but: there is insufficient time to secure the offset sites at the time the decision is made; or the proposal is to use the services of a third party provider such as the Nature Conservation Trust to secure offset sites and an estimate of cost is required.	Convert credits required to hectares using the credit to ha converter and ensure that the approval: specifies the type, location and condition of offsets; and secured offset sites in accordance with the requirements of section 5 of this Policy. An estimate of the cost of the offset can be made by using a Valuer Generals estimate of land value.	Proposed offset site meets the minimum area standard offset to clearing ratio of 2:1 and retires biobanking credits.

<b>Variation criteria</b>	<b>When is this option appropriate</b>	<b>How</b>	<b>Consideration in relation to NBH proposal</b>
e) Waive the requirement for species credits NB: This criteria should not be used for EPBC Act listed species where the proposal is a controlled action	Where no matching credits are available and all ecosystem credits have been obtained in accordance with this policy	Remove the requirement	It is possible for the shortfall in species credits to be waived as all ecosystem credits have been obtained in accordance with this policy - minimum area standard offset to clearing ratio of 2:1.
f) Convert ecosystem credits to a regional conservation priority as identified in a regional conservation plan or similar	When no matching credits are available and variation 1 is not feasible	Identify areas of high conservation priority in existing regional conservation plans or similar. Convert credits required to hectares <sup>1</sup> . Identify eligible offset sites and ensure areas are of sufficient size, condition and landscape context.	Contiguous with Garigal National Park (will be added to National Park upon retirement of credits). Identified in the Draft Warringah Council Biodiversity Study as having high conservation significance.

## 4 Preferred biodiversity offset strategy

HI has considered offsetting as a mitigation measure for the unavoidable loss of DFEC habitat associated with the hospital.

The OEH interim policy is applicable to the hospital development as it meets the scope and application of the interim policy being an SSI project that cannot meet the 'improve or maintain' standard required under the biobanking scheme, but adopts the use of the BBAM. BBAM approval for clearing of red flag areas usually requires development to improve or maintain biodiversity values, however special circumstances exist for SSD and SSI projects via the tiered approach in the interim policy.

In seeking to provide a transparent and consistent approach to offsetting the impacts of DFEC removal, it is proposed to adopt a Tier 3–Mitigated Net Loss approach consistent with the OEH interim policy. In addition to the information provided in Section 3 of this report, additional justification of the rationale for this approach is as follows:

- There are currently only 30 available credits on market for ME039, this being the only DFEC vegetation (BioBanking public register 9 August 2013) on the market. There are no available credits for the Powerful Owl.
- Discussions between HI and Waste Assets Management Corporation (WAMC) have been undertaken in relation to the retirement of credits detailed in BioBanking Agreement ID number 55 (Agreement 55) (Appendix B). Negotiations between HI and WAMC have determined that a mutually beneficial solution would be to fully retire the whole package of ecosystem and species credits for the hospital development. Under the agreement, 10 ha would be formally secured in the same formation and IBRA bioregion, of which 4.18 ha is Red Bloodwood-Smooth-barked Apple shrubby forest on shale or ironstone (ME039). The 10 ha at Belrose meets the minimum area standard for offset to clearing ratio of 2:1 as stipulated in Attachment B: variation criteria for mitigated net loss (Tier 3) to the interim policy, and is located less than eight kilometres from the hospital site.
- It is noted that under variation criterion d), where ecosystem credits are converted to hectares, 35 ha at a suitable offset site would be required (see James 2013). It is proposed to adopt the minimum offsetting ratio of 2:1 as described above because:
  - Other suitable offset sites in the same bioregion are not known to be readily available on the market
  - The high value of land in the Northern Beaches region would result in unreasonable cost in securing any offset site (assuming it was available) of sufficient ecological scale and location to meet the additional 25 ha required in variation criterion d)
  - The average cost per credit to HI to retire all credits in Agreement 55 is in the higher market average range at \$6,098 per credit. In total HI would spend over \$700,000 to offset the ecological impacts from the hospital development through Agreement 55 with WAMC.
- HI would be purchasing and retiring 17 Red-crowned Toadlet and 29 Rosenberg's Goanna species credits as part of the WAMC negotiations in Agreement 55. It is noted that these species have a greater conservation priority than the Powerful Owl in the Pittwater region. It is proposed that 46 of the 121 Powerful Owl species credits be retired as per variation

criterion b) in Attachment B to the offset policy. Regarding the remaining 75 species credits required for the Powerful Owl, it is proposed that these be waived in accordance with variation criterion e) in Attachment B to the offset policy.

- WAMC has made arrangements with NPWS that the land area covered under Agreement 55 would be absorbed into adjoining Garigal National Park, effectively increasing its area and securing formal management as an ecological reserve in accordance with the management plan prescribed in Agreement 55 (Appendix B).

It is considered that this offset strategy is fully consistent with the offset policy. It provides an opportunity to retire biodiversity credits of a whole site as part of the NSW Biobanking Scheme. It will ensure protection of an area of Duffy's Forest equivalent to that being impacted at the development site and result in a significant addition of land to Garigal National Park to be formally managed as a conservation reserve. The strategy is also a financially viable solution for HI that can be achieved within a reasonable timeframe and provides a balanced outcome when considering the broader social and economic benefits of the proposal.

## Appendix A

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NSW OEH interim policy on assessing and offsetting biodiversity impacts of Part 3A, State significant development (SSD) and State significant infrastructure (SSI) projects





# NSW OEH interim policy on assessing and offsetting biodiversity impacts of Part 3A, State significant development (SSD) and State significant infrastructure (SSI) projects

Approved by the Chief Executive Officer 25 June 2011

## 1 Introduction

Offsetting is one practical tool for decision makers who have to balance the relative environmental, social and economic merits of development proposals under the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The NSW Office of Environment and Heritage (OEH) has developed the Biobanking Scheme to provide a structured, market driven approach to offsetting. The Biobanking Scheme requires proposals to meet the 'improve or maintain' standard, and is based on sound science and robust, transparent rules.

The Biobanking Scheme is voluntary and many proposals in NSW are assessed outside the Scheme. The majority of these proposals have been assessed by the Department of Planning and Infrastructure (DP&I) as major projects under Part 3A of the EP&A Act. DP&I have now repealed Part 3A. Most developments that would previously have been assessed and determined under Part 3A will now fall into either:

- Part 4 – State Significant Development (SSD): these will be projects put forward by the private sector and determined by the Planning Assessment Commission.
- Part 5.1 – State Significant Infrastructure (SSI): infrastructure projects undertaken by or on behalf of public authorities and determined by the Minister for Planning and Infrastructure.

There are also transitional arrangements for existing projects that will continue to be assessed and processed as Part 3A projects. For the purposes of this policy these existing proposals will continue to be referred to as Part 3A; SSD and SSI are referred to collectively as 'State significant projects'.

A proportion of Part 3A and State significant projects also affect nationally listed threatened species and threatened ecological communities (TECs). These proposals are considered by the Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The question of suitable offsetting often arises in the context of these decisions. This policy seeks to provide a consistent and transparent approach to impact assessment and offsetting for projects assessed under Part 3A or as SSD or SSI. This policy also provides the basis for aligning NSW and Commonwealth assessment and offsetting processes by providing an assessment pathway that is likely to satisfy both NSW and DSEWPC requirements provided that certain standards are met.

This policy will operate on a trial basis in partnership with DSEWPC and DP&I until 30 June 2012, and will be reviewed at the end of this period.

## 2 Scope and application

This interim policy relates to proposals that are assessed by DP&I under the Part 3A, SSD or SSI provisions of the EP&A Act, and are not being considered as part of the Biobanking Scheme.

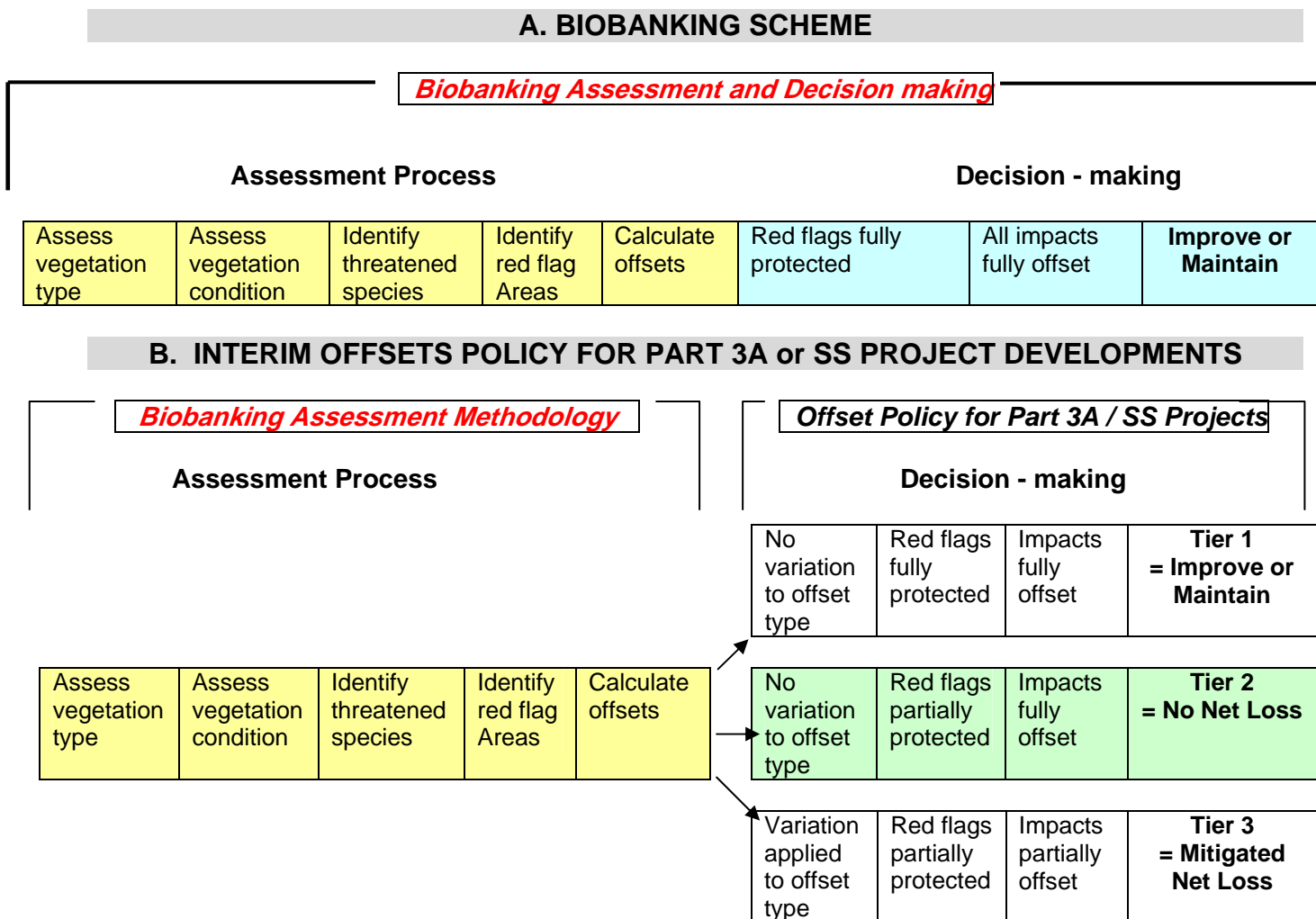
This interim policy:

- acknowledges that proposals assessed as State significant projects or Part 3A do not have to meet the "improve or maintain" standard, which is required under the Biobanking scheme;
- nevertheless, adopts the use of the Biobanking Assessment Methodology (BBAM) for the purpose of:
  - > quantifying and categorising the biodiversity values and impacts of State significant projects or Part 3A proposals;

- > establishing, for benchmarking purposes, the offsets that would be required if the State significant project or Part 3A proposal had been expected to meet the improve or maintain standard;
- provides a structured approach to determining how proposals may, in lieu of meeting the improve or maintain standard, meet one of two alternative standards established under this policy.

Diagram 1 illustrates how the BBAM is applied under this policy, in contrast to its application under the BioBanking Scheme.

**Diagram 1: Application of the Biobanking methodology to Part 3A and State significant (SS) project offsetting decisions**



This interim policy does not apply to:

- decisions on developments under Part 4 or 5 of the EP&A Act (except SSD under Part 4 or SSI under 5.1 of the EP&A Act); or
- decisions on the making of environmental planning instruments (EPIs) under Part 3 of the EP&A Act.

### 3 Definitions

BBAM:

Biobanking Credit Calculator:

Biodiversity Credits:

DGRs:

Biobanking Assessment Methodology

As defined under the BBAM

Ecosystem or species credits required to offset the loss of biodiversity values on development sites or created on biobank sites from management actions that improve biodiversity values

Director-General's Requirements for either an EIS (issued by DP&I) or a SIS (issued by OEH)

EARs	Environmental Assessment Requirements
Ecosystem credit:	As defined by the <i>Threatened Species Conservation Act 1995</i> (TSC Act)
EPI:	Environmental Planning Instrument as defined by the EP&A Act
ESD:	Ecologically Sustainable Development
State significant project:	Collectively State significant development and State significant infrastructure projects
Planning authority:	A person or body exercising and consent or approval role under the EP&A Act – usually a Council or DP&I;
Proponent:	A person or body seeking consent or approval under the EP&A Act.
Red flag:	As defined by the BBAM – areas of particular conservation significance of sufficient scale to be viable over the medium to long term.
Relevant planning decisions	Decisions made by DP&I under Part 3A, 4 or 5.1 of the EP&A Act
Variation criteria:	Options outlined in this policy vary the offsetting requirement in certain circumstances
Species credit:	As defined by the TSC Act
SSD:	State significant development as defined by the EP&A Act
SSI:	State significant infrastructure as defined by the EP&A Act
Threatened Species concurrence and consultation decisions:	Decisions made under section 79(B), in the case of Part 4 EP&A Act matters, and sections 112B and 112C, in the case of Part 5 matters
Voluntary planning Agreement	A planning agreement as defined by the EP&A Act

## 4 OEH's policy on impact assessment and offsetting

Attachment A sets out the process for Part 3A proposals considered under this policy. It is expected to be similar for State significant projects (this will be confirmed after release of the new regulations outlining the State significant project process).

### 4.1 Determining offset requirements

Under this policy, the Biobanking Assessment Methodology (BBAM) is used for the following purposes:

- to describe, quantify and categorise the biodiversity values and impacts of a proposal;
- to identify, for benchmarking purposes, the offsetting that would be required to meet the improve or maintain standard; and
- to provide the information for calculating offsets under this policy.

The BBAM is an assessment tool that allows the impacts of a proposal and its offsetting requirements to be calculated in a consistent and transparent way. The BBAM can be applied on:

- a voluntary basis by the proponent, either on a formal basis as part of the Biobanking Scheme, or as part of the assessment of a State significant project or Part 3A proposal;
- by OEH to inform its submissions to the DP&I on State significant project or Part 3A proposals. In such cases OEH would be using the assessment information provided by the proponent to assess likely impacts and calculate offset requirements.

OEH will support both of these options being implemented by:

- Amending and then recommending standard Environmental Assessment Requirements for State significant projects or Part 3A to include the option for the proponent to use the BBAM in his or her environmental assessment; and
- Internally applying the BBAM to State significant projects or Part 3A proposals using the information provided by the proponents in their Environmental Assessment; and using that

assessment and this policy as the basis for OEH submissions on State significant projects or Part 3A proposals. (See Attachment A.)

Due to resourcing constraints it will not be possible for OEH to undertake this work for all State significant projects or Part 3A proposals but all efforts should be made to use the BBAM where the State significant project or Part 3A proposal is or is likely to be an EPBC Act controlled action.

Where it is not possible due to resourcing constraints to apply the BBAM, offsets are to be negotiated on a case by case basis and in accordance with OEH's offsetting principles (See <http://www.environment.nsw.gov.au/biocertification/offsets.htm> ). The *NSW OEH interim policy on assessing and offsetting biodiversity impacts of Part 3A, State significant development (SSD) and State significant infrastructure (SSI) projects* is not relevant to offsets that have been calculated without applying the BBAM.

The Policy provides for a range of mechanisms to be used to implement offsets (ie. not only biobanking credits) in view of the currently limited supply of biodiversity credits on the market.

The Policy describes 3 possible outcomes that proposals should strive to meet depending on the circumstances. These outcomes are described in Table 1.

**Table 1: Offsetting calculations using the BBAM\***

Outcome achieved	Level of impact	Offsetting requirement
- Improve or maintain (Tier 1)	- red flag assets protected and clearing only occurs within the variation rules set by the BBAM	- calculated by the credit calculator**
- No net loss (Tier 2)	- some/all red flags not protected and clearing allowed outside the variations rules permitted by the BBAM	- calculated by the credit calculator**
- Mitigated net loss (Tier 3)	- as for 'no net loss'	- calculated by the credit calculator but then amended by the offset variation criteria contained in Attachment A of this policy to a minimum land offset to clearing ratio of 2:1

\* These standards do not apply where the BBAM has not been used as it is not possible to identify red flags or credit requirements in the absence of the BBAM assessment.

\*\* The difference between Tier 1 and 2 relates only to the clearing of red flags. The amount of offsetting required is the same for both Tiers

OEH's submissions will advocate that proposals deliver at least one of these outcomes, with "improve or maintain" (Tier 1) being preferred.

## **4.2 Determining an appropriate outcome**

### **Tier 1: "Improve or Maintain"**

While not required of State significant projects or former Part 3A proposals, the "Improve or Maintain" nevertheless represents a high standard of biodiversity protection. OEH should set out in its submissions to DP&I the requirements for meeting this standard. DSEWPC has advised that proposals that meet the "Improve or Maintain" standard are likely to satisfy its requirements for impact assessment and offsetting.

A proposal can fall short of the "Improve or Maintain" standard in two main ways: either red flag assets are to be cleared outside the rules allowed by the BBAM; and/or the amount and type of offsetting secured is inconsistent with the requirements of the BBAM credit calculator.

### **Tier 2: Negotiating a "No Net Loss" outcome**

'No Net Loss' is attained when it is proposed to clear red flags outside the variation rules permitted by the BBAM, but all impacts are to be fully offset in accordance with the BBAM requirements.

In deciding whether this is appropriate, consideration should be given to:

- a) whether any feasible alternatives exist that would avoid clearing;
- b) the value of the resource (in the case of extractive industries) or other economic benefits and the likely contribution of the proposal to local and regional economies.

Most Part 3A proposals and State significant projects are of social and economic significance to State and regional economies. It is for DP&I to compare and balance the significance of economic or social benefits, and potential environmental (including biodiversity) impacts and gains.

DP&I has prepared draft social and economic impact assessment guidelines to assist decisions makers balance social, economic and environmental outcomes. OEH will work with DP&I on the preparation of these guidelines and their subsequent integration with future versions of this policy.

Proposals that meet the 'No Net Loss' outcome may satisfy DSEWPC requirements for impact assessment and offsetting provided that a sound economic and social justification for anticipated impacts is provided.

### Tier 3: Negotiating a "Mitigated Net Loss" outcome

"Mitigated Net Loss" occurs when red flag assets are to be cleared and this clearing is considered acceptable under the requirements set out for no net loss; and the amount and type of offsetting proposed is inconsistent with the requirements of the BBAM credit calculator. In considering whether the mitigated net loss standard is appropriate, consideration should be given to:

- a) whether the credits required by the calculator are available on the market;
- b) whether alternative offset sites (other than credits) are available on the market;
- c) the overall cost of the offsets and whether these costs are reasonable given the circumstances.

Should any of these circumstances apply, then it is reasonable to apply the variation criteria to the point that:

- a) suitable offset sites can be found within a reasonable<sup>2</sup> timeframe;
- b) the costs of offsetting is brought within a reasonable range; and
- c) an offset to clearing ratio of at least 2:1 vegetated to cleared hectares is achieved.

The variation criteria are set out at Attachment B. In summary the variation criteria:

- Make provision for the conversion of ecosystem credits to another type of ecosystem credit;
- Make provision for conversion of one type of ecosystem credit to another type of ecosystem credit and for the waiving of species credits in some circumstances;
- Remove the need for offsets where clearing is minimal and confined to non-threatened vegetation; and
- Make provision for the conversion of ecosystem and species credits to hectares which, in turn, allows the land value of the offset to be estimated. In this way, approvals can be issued that specify either the hectares or the financial contribution that would need to be made to secure the land required for offsetting.

OEH should set out in its submissions to DP&I the requirements for meeting this standard.

Proposals that meet a mitigated net loss outcome will be considered on merit by DSEWPC.

## **5 Securing an offset site**

### **5.1 Criteria for determining suitability of an offset site**

OEH offset principles require offsets to be managed under effective and secure long term management arrangements. Dedication of land under the *National Parks and Wildlife Act 1974* (NPW Act), and the establishment of biobanking sites with Biobanking Agreements under the TSC Act, meet this requirement because:

- a) The unambiguous principal objective of ongoing site management is biodiversity conservation;

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<sup>2</sup> What is "reasonable" is contingent upon a range of factors and needs to be considered on a case by case basis.

- b) Management is undertaken in accordance with a Plan of Management;
- c) There is reasonable likelihood that sufficient resourcing will be available to implement the Plan of Management over-time;
- d) The arrangements are in-perpetuity, and conservation obligations are transparently transferred and disclosed to any new owners of the land through appropriate administrative procedures; and
- e) There are appropriate accountability mechanisms to secure the outcomes and these mechanisms cannot be altered without alternative and comparable offsetting arrangements being put in place.
- f) An alternative to establishing biobanking sites is to retire biobanking credits, where appropriate credits are available. The Minister for Planning may approve a project under Part 3A subject to a condition that requires a proponent to acquire and retire biodiversity credits of a specified number and class (section 75JA, EP&A Act). S.89I and 115ZC allow approvals for all State significant projects to include conditions that require biodiversity credits to be obtained and retired by the proponent.

Other conservation mechanisms may also meet the criteria in certain circumstances. These include:

- a) Conservation Agreements under the NPW Act;
- b) Trust Agreements under the *Nature Conservation Trust Act 2001* (NCT Act);
- c) A Property Vegetation Plan registered on title under the *Native Vegetation Act 2003* (NV Act); and
- d) A Planning agreement under s93F of the EPA Act.

The suitability of these mechanisms (or any other mechanism) depends on whether the proposed arrangements are likely to result in the management of the land in accordance with the five criteria above.

## 5.2 Offsetting and reservation under the NPW Act

If an offset site is proposed that may involve the transfer of land to OEH for reservation under the NPW Act, then consultation must occur with the relevant PWG Branch Director at the earliest possible stage. No commitment should be made to accept an offset involving new reserves without the agreement of the Deputy Chief Executive, PWG. Similarly, no commitment should be made to accept offsets involving other forms of in-perpetuity protection without the agreement of the relevant sponsoring body.

## 6 Implementation and accountabilities

Staff may use the BBAM only if they have been trained. Some Catchment Management Authorities (CMAs) have indicated an interest in participating in offsetting discussions and may be available to assist OEH to undertake this work. OEH, however, will remain the lead Agency responsible for offsetting negotiations on behalf of the Environment portfolio. Positions with significant responsibilities under this interim policy are listed below.

Position	Responsibility
Director, LEC Manager, Conservation Policy and Strategy, LEC	Policy development and review
Manager, Biodiversity and Vegetation Programs	Issue biobanking statements and agreements State-wide co-ordination of biobanking program Overall program support including Biobanking helpline, Workshops and Training and accreditation programs.
Regional Director, EPRG	To approve the communication of BBAM outcomes to proponents and planning authorities To approve amendments to credit requirements in accordance with the requirements of this policy To liaise with PWG Branch Directors on offset proposals involve new reserves
Manager, Planning and Aboriginal Heritage,	To approve use of BBAM by OEH staff when dealing with

EPRG Manager, Metro Projects and Support (Metro only), EPRG Manager Environment and Conservation Programs (NW only), EPRG Manager, Regional Operations, EPRG	SSD, SSI or Part 3A matters
Regional Operations Officers, EPRG Catchment Management Officer, CMA	Must be trained in BBAM in order to apply to methodology

## 7 Policy review

This interim policy will be reviewed by 30 June 2012.

## 8 Contacts for further advice

For further advice on this policy please contact:

Ms Julie Ravallion, Manager, Conservation Policy and Strategy on 02 9995 6729

For advice offsetting and new reserve proposals please contact Mr Ray Fowke, Environment Planning Advisor on 02 9585 6607

For advice on the Biobanking Scheme please contact the Biobanking helpline.

## 9 Related policies and other documents

BioBanking Assessment Methodology and Credit Calculator Operational Manual, March 2009,  
<http://www.environment.nsw.gov.au/resources/biobanking/09181bioopsman.pdf>

OEH's offsetting principles can be found at:

<http://www.environment.nsw.gov.au/biocertification/offsets.htm>

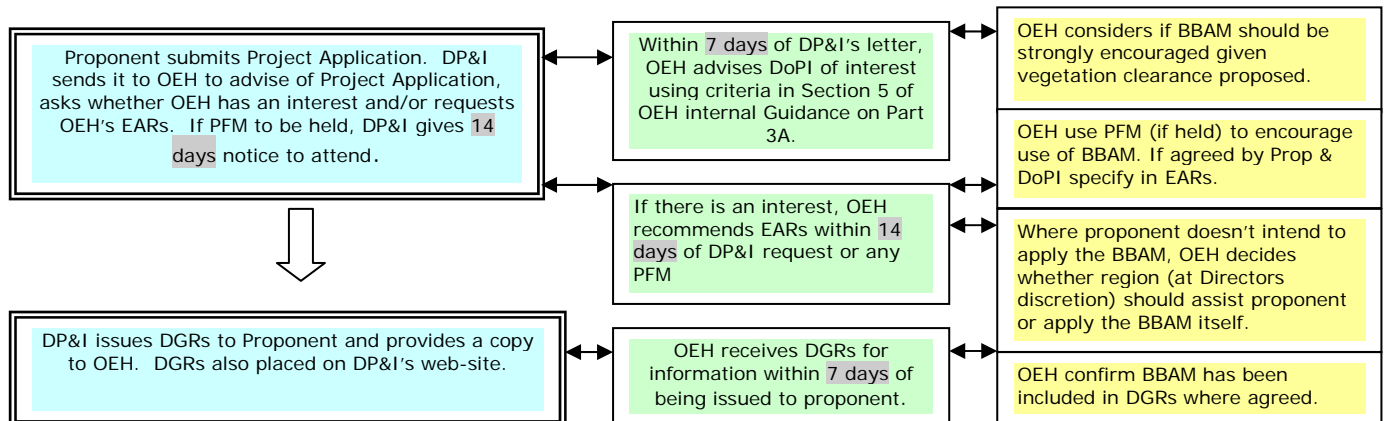
The Department of Sustainability, Environment, Water, Population and Communities' draft offsetting policy can be found at:

(<http://www.environment.gov.au/epbc/publications/draft-environmental-offsets.html>)

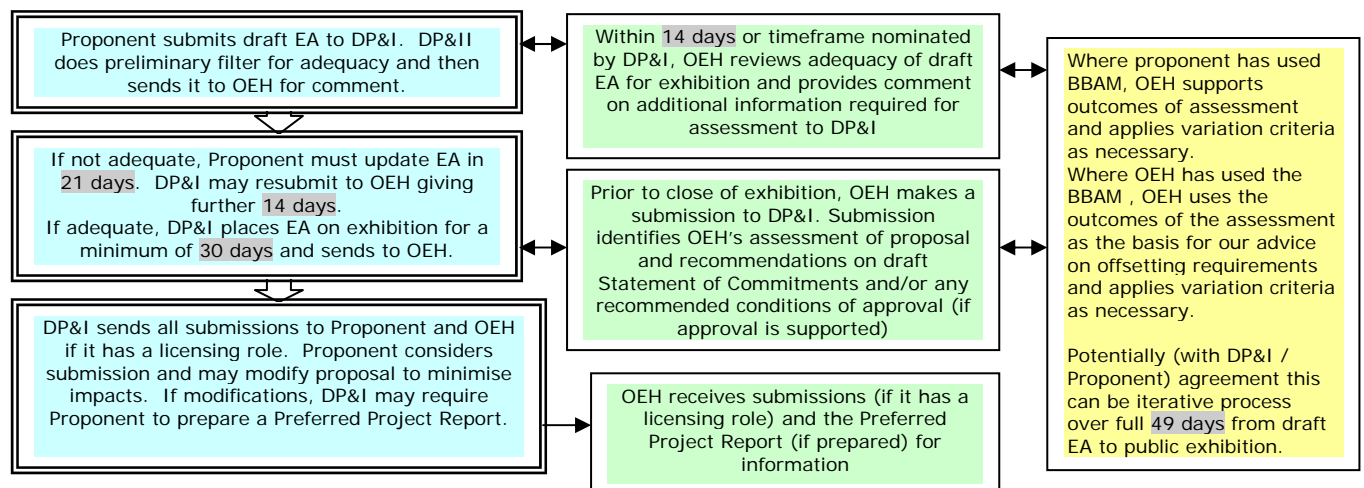
# Attachment A: Typical Project Application's Process under Former Part 3A

Note: The project application process for State significant projects is under development (as of July 2011)

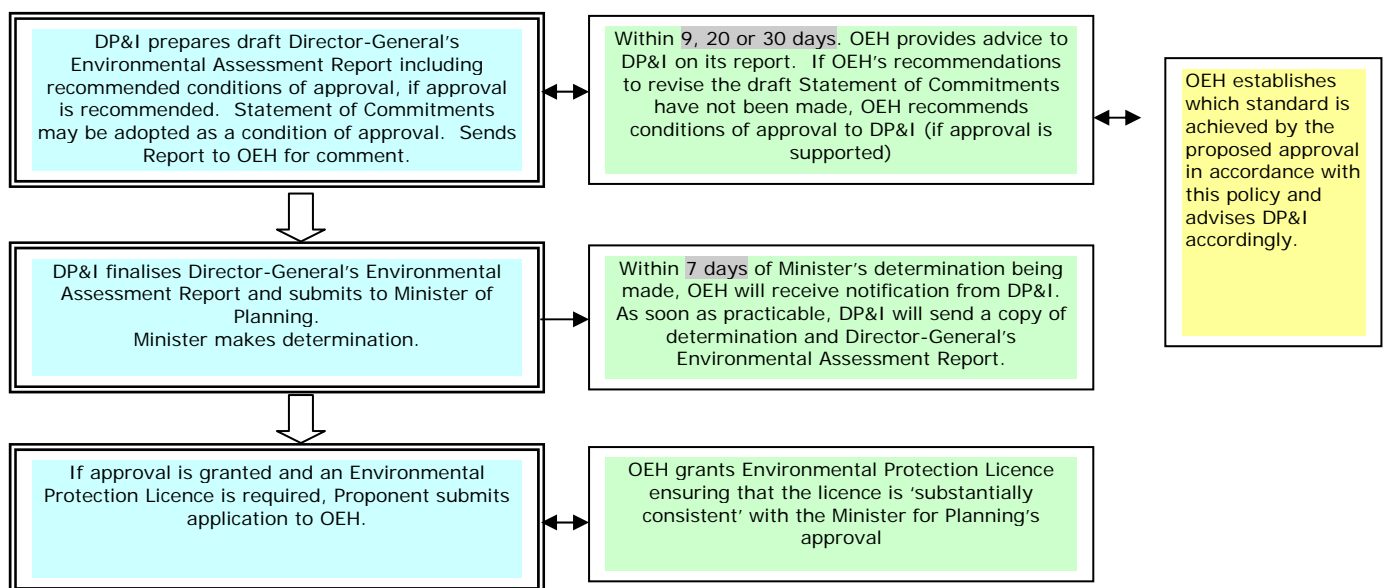
## Stage 1: Project Application and requirements of Environmental



## Stage 2: Exhibition, Consultation and Review



## Stage 3: Assessment and Determination



Notes - All times are in calendar days.

DP&I Department of Planning and Infrastructure

DGRs Director-General's Requirements

EA Environmental Assessment

DP&I /Proponent Statutory Requirements

EARS

PFM

OEH Statutory Requirements

Environmental Assessment Requirements

Planning Focus Meeting

Offset Policy Requirements



## Attachment B: Variation criteria for mitigated net loss (Tier 3)

To achieve Tier 3 - mitigated net loss standard, the following variation criteria may be applied to the offsetting requirements of the BBAM. The minimum area standard is an offset to clearing ratio of 2:1.

Variation criteria	When is this option appropriate	How
a) Convert ecosystem credits for one vegetation type to any vegetation type within the same vegetation formation in the same IBRA bioregion	When no matching ecosystem credits are available	Review to biometric vegetation database to identify vegetation types in the same formation in the same IBRA bioregion.  Number of credits should be the same.
b) Convert one type of species credit to another type of species credit with the same or more endangered conservation status	When species credit is not available and the matching species credit is considered a greater conservation priority.	Review conservation status of species  Number of credits should be the same
c) Remove/reduce the need for offsetting	Where clearing is minimal (less 4 ha) and where the vegetation is not a highly cleared vegetation type or a Commonwealth or State listed TEC.	Identify and remove credits required for offsetting vegetation under 4ha and for vegetation types that aren't greater than 70% cleared or a Commonwealth or State listed TEC
d) Convert ecosystem credits required to hectares and, if necessary, convert hectare figure to an estimate of land value	Where suitable offset sites are known to exist but: <ul style="list-style-type: none"> <li>there is insufficient time to secure the offset sites at the time the decision is made; or</li> <li>the proposal is to use the services of a third party provider such as the Nature Conservation Trust to secure offset sites and an estimate of cost is required.</li> </ul>	Convert credits required to hectares using the credit to ha converter <sup>1</sup> and ensure that the approval: <ul style="list-style-type: none"> <li>specifies the type, location and condition of offsets; and</li> <li>secured offset sites in accordance with the requirements of section 5 of this Policy.</li> </ul> An estimate of the cost of the offset can be made by using a Valuer Generals estimate of land value.
e) Waive the requirement for species credits  NB: This criteria should not be used for EPBC Act listed species where the proposal is a controlled action	Where no matching credits are available and all ecosystem credits have been obtained in accordance with this policy	Remove the requirement
f) Convert ecosystem credits to a regional conservation priority as identified in a regional conservation plan or similar	When no matching credits are available and variation 1 is not feasible	Identify areas of high conservation priority in existing regional conservation plans or similar. Convert credits required to hectares <sup>1</sup> . Identify eligible offset sites and ensure areas are of sufficient size, condition and landscape context.

OEH is currently finalising an excel spreadsheet which converts credits to hectares. This spreadsheet will be lodged on the OEH intranet site.



## Appendix B

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Biobanking agreement ID number: 55 (for Belrose Garigal biobank site, Lot 2826 in Deposited Plan 729336)





**Biobanking agreement  
ID number: 55**

**Under the  
*Threatened Species Conservation Act 1995***

**for**

**Waste Assets Management Corporation  
for  
Belrose Garigal biobank site  
Lot 2826 in Deposited Plan 729336**



**Biobanking agreement under Part 7a Division 2 of the *Threatened Species Conservation Act 1995***

**This agreement** made on the nineteenth day of March 2012 **between** the Minister for the Environment of the State of New South Wales, being the Minister currently administering the *Threatened Species Conservation Act 1995* (**'the Minister'**), which expression shall where the context admits, be deemed to include his or her successors (in office) on the one part and Waste Assets Management Corporation (ABN 56 784 733 957) (**'the landowner'**) of 10 Valentine Avenue, PARRAMATTA NSW 2150 on the other part.

**Background**

- A The landowner is the owner, as defined under section 127(1) of the Act, of the land.
- B The Minister and the landowner have agreed to enter into this agreement relating to the land for the purpose of establishing the biobank site.
- C The biobank site the subject of this agreement, and as shown in the Biobank Site Boundary Map in Annexure A forms a part of the land.
- D The Minister and landowner recognise that the landowner will receive biodiversity credits determined in accordance with the BioBanking Assessment Methodology (and set out in Annexure B) relating to the impact or likely impact of the management actions required to be carried out under Clause 3 and Annexure C of this agreement regarding the biodiversity values listed in Annexure B.
- E The landowner and the Minister recognise that this biobanking agreement is being entered into for the purposes of the BioBanking Scheme established under Part 7A of the Act.
- F The landowner agrees to undertake the management actions as set out in Annexure C to improve the biodiversity values of the biobank site as set out in Annexure B.
- G The landowner agrees to undertake monitoring, reporting and record keeping as set out in Annexure D.
- H The landowner and the Minister recognise that the biobank site contains the following known Aboriginal objects and/or Aboriginal places as defined by the *National Parks and Wildlife Act 1974*:

'None applicable'

Note: This biobanking agreement only recognises the existence of known Aboriginal objects and/or Aboriginal places. It does not provide for the protection of Aboriginal objects or Aboriginal places. The protection of Aboriginal objects and Aboriginal places is dealt with by the *National Parks and Wildlife Act 1974*. This agreement does not authorise any person to damage or to cause or permit damage to an Aboriginal object or Aboriginal place in, on or under the biobank site land (see clause 2.2).

- I Accordingly, the parties hereby enter into the following biobanking agreement under section 127D of the *Threatened Species Conservation Act 1995*.
- J The Minister has delegated the power to enter into this agreement to the Chief Executive of the Office of Environment and Heritage

**Now this agreement witnesses:**

## **1 Interpretation**

1.1 In this agreement, unless the contrary intention appears:

the '**Act**' means the *Threatened Species Conservation Act 1995* and any regulations from time to time in force thereunder

**'adaptive management'** means a process for improving management where the outcomes of monitoring indicate that minor alterations to the management actions are required to improve biodiversity values

**'agreement'** means this biobanking agreement entered into by the Minister and the landowner under section 127D of the Act for this biobank site

**'animal'** has the same meaning as in section 4 of the Act

**'Annexure A'** means Annexure A to this agreement entitled 'Maps of biobank site'

**'Annexure B'** means Annexure B to this agreement entitled 'BioBanking Agreement Credit Report'

**'Annexure C'** means Annexure C to this agreement entitled 'Management actions for the biobank site'

**'Annexure D'** means Annexure D to this agreement entitled 'Monitoring, reporting and record keeping requirements'

**'Annexure E'** means Annexure E to this agreement entitled 'Payment schedules'

**'annual report'** means the annual report to be prepared by the landowner in accordance with the requirements of item 2 of Annexure D

**'authorised officer'** means a person appointed under section 156B of the *National Parks and Wildlife Act 1974*

**'biobank site'** means that part of the land shown on the biobank site boundary map and marked as 'Biobank Site Boundary 10 ha'

**'biobank site boundary map'** means the map entitled 'Biobank Site Boundary' dated 11/05/2010 and included in Annexure A to this agreement

**'Biobanking Agreement Credit Report'** means the report contained in Annexure B generated by a BioBanking Assessor for the biobank site using the BioBanking Assessment Methodology and the BioBanking Credit Calculator which includes the number and type of biodiversity credits to be created on the biobank site

**'biobanking agreements register'** means the register of biobank sites kept by the Director General under Part 7A of the Act

**'BioBanking Assessment Methodology'** means the rules established under section 127B of the Act

**‘BioBanking Regulation’** means the Threatened Species Conservation (Biodiversity Banking) Regulation 2008

**‘BioBanking Scheme’** means the Biodiversity Banking and Offsets Scheme established under Part 7A of the Act

**‘BioBanking Trust Fund’** means the fund established under Part 7A of the Act to hold funds from the sale of credits (the Total Fund Deposit)

**‘biodiversity credits’** means biodiversity credits created under Part 7A of the Act

**‘biodiversity credits register’** means the register of biodiversity credits kept by the Director General of OEH under Part 7A of the Act

**‘biodiversity values’** has the same meaning as in section 4A of the Act

**‘critical habitat’** has the same meaning as in section 4 of the Act

**‘commencement date’** means the date this agreement commences in accordance with clause 18 of this agreement

**‘day’** means any day including Saturdays, Sundays and public holidays

**‘development’** has the same meaning as in section 127(1) of the Act

**‘Director General’** has the same meaning as in section 4 of the Act

**‘ecological burn’** means a burn to improve biodiversity values carried out as part of the management of fire for conservation

**‘fee unit’** has the same meaning as in the BioBanking Regulation

**‘Fund manager’** means the person appointed by the Minister from time to time under Part 7A of the Act as the fund manager to manage the BioBanking Trust Fund

**GST** has the same meaning as given to that term in *A New Tax System (Goods and Services Tax) Act 1999* (Cth) and any other Act or regulation relating to the imposition or administration of the GST

**‘land’** means that parcel of land described in paragraph A of the Background to this agreement

**‘landowner’** has the same meaning as ‘owner’ in section 127(1) of the Act and includes successors in title referred to in section 127J of the Act

**‘management action’** means the actions to be carried out by the landowner on the biobank site to improve biodiversity values for which biodiversity credits may be created. Such actions are set out in of Annexure C. A reference to a management action includes a reference to refraining from doing anything, whether or not that thing was being done beforehand

**“management of fire for conservation”** means the controlled application of fire under specified environmental and weather conditions to a predetermined area and at the time, intensity and rate of spread required to attain planned improvement of biodiversity values



**‘management of grazing for conservation’** is the implementation of a variable and adaptive stock grazing regime for improving biodiversity values, such as for controlling exotic weeds or vegetation biomass, or enhancing the competitiveness of native perennial species. Typically it involves short periods of intensive grazing between long periods of little or no grazing. Management of grazing for conservation differs with site condition, specific management goals, seasonal conditions and regions

**‘management payments’** means the payments to be made to the landowner in accordance with the payment schedules and Annexure E

**‘management plans’** means the management plans to be implemented by the landowner in carrying out the management actions and included in Section 3 and Section 4 of Annexure C (or such other management plans as approved by the Director General in accordance with the provisions of Annexure C)

**‘management zones’** means the areas of the biobank site described as “Vegetation and Management Zones” as shown on the vegetation and management zones map

**‘maximum operational surplus’** has the same meaning as in clause 33(2) of the BioBanking Regulation

**‘Minister’** means the Minister for the time being administering the Act and where not repugnant to the context includes the servants and agents of the Minister

**‘native animal’** has the same meaning as in section 5 of the *National Parks and Wildlife Act 1974*

**‘native plant’** has the same meaning as in section 5 of the *National Parks and Wildlife Act 1974*

**‘native regrowth’** as defined by the *Native Vegetation Act 2003* means any native vegetation that has regrown since the earlier of the following dates:

- (a) 1 January 1983 in the case of land in the Western Division and 1 January 1990 in the case of other land,
- (b) the date specified in a property vegetation plan for the purposes of this definition (in exceptional circumstances being a date based on existing rotational farming practices)

**‘native vegetation’** has the same meaning as in section 6 of the *Native Vegetation Act 2003*

**‘NPW Act’** means the *National Parks and Wildlife Act 1974* and any regulations from time to time in force thereunder

**‘ongoing’** in relation to the timing of carrying out a management action means commencing at the date this agreement is made and continuing in perpetuity, unless indicated otherwise

**‘operational deficit’** has the same meaning as in clause 31(2) of the BioBanking Regulation

**‘operational deficit threshold’** has the same meaning as in clause 32(2) of the BioBanking Regulation

**‘operational surplus’** has the same meaning as in clause 31(3) of the BioBanking Regulation

**‘party’** means a party to this agreement

**‘payment schedules’** means the tables entitled ‘payment schedule’ and ‘in perpetuity management costs’ included in paragraph 2.5 of Annexure E setting out the timing and amount of management payments to be made under this agreement

**‘pesticide’** has the same meaning as in section 5 of the *Pesticides Act 1999* which includes herbicides, insecticides, fungicides, baits and rodenticides

**‘plant’** has the same meaning as in section 4 of the Act

**‘planting schedule’** means the schedule at item 6.6 of Section 1, Annexure C

**‘processing fee’** means the processing fee which is to accompany an application to enter into a biobanking agreement as required by clause 14 of the BioBanking Regulation

**‘record keeping requirements’** means those record keeping requirements set out in item 3 of Annexure D

**‘regrowth’** has the same meaning as in section 9 of the NV Act

**‘relevant biobank site account’** means the biobank site account within the BioBanking Trust Fund created for the biobank site

**remnant native vegetation’** has the same meaning as in section 9 of the NV Act

**‘threatened species, populations and ecological communities’** and **‘threatened species, population or ecological community’** have the same meaning as in the Act

**‘Total Fund Deposit’** has the same meaning as in clause 26(1) of the BioBanking Regulation

**‘vegetation and management zones map’** means the map entitled ‘Vegetation and Management Zones’ dated 10 /01/11 and included in Annexure A

**‘waste’** has the same meaning as in the *Protection of the Environment Operations Act 1997*.

- 1.2 A word or expression that indicates one or more particular genders shall be taken to indicate every other gender. A reference to a word or expression in the singular form includes a reference to the word or expression in the plural form, and vice versa.
- 1.3 Any reference to an action, or carrying out an action, includes a reference to doing anything or refraining from doing anything.
- 1.4 Any reference to a person shall be deemed to include a corporate body and vice versa.
- 1.5 Any covenant or agreement on the part of two or more persons shall be deemed to bind them jointly and severally.
- 1.6 The schedules and Annexures to this agreement form part of this agreement.

- 1.7 Any notes included in the agreement do not form part of the agreement.

## **2 Status of this agreement**

The parties agree that this agreement is a biobanking agreement within the meaning of section 127D of the Act.

## **3 Use of the biobank site**

The landowner covenants with the Minister as follows:

### **General responsibilities**

- 3.1 Except as otherwise permitted by this agreement, the landowner must not carry out any act or omit to carry out any act, or cause or permit any act to be carried out or any act not to be carried out which act or omission may harm biodiversity values on the biobank site, including but not limited to any native animals, native plants, threatened species, populations and ecological communities, and their habitats.

Note: The clearing of native vegetation that is otherwise permissible in accordance with the NV Act (whether it is permissible under a Property Vegetation Plan, routine agricultural management activity (as defined under the NV Act), or is otherwise permitted under Part 3 of that Act) can only be carried out on the biobank site to which this agreement applies if it is also permissible under this agreement. Item 5.1 of the management actions contained in Section 1 of Annexure C of this agreement sets out the limited circumstances in which native vegetation can be cleared on the biobank site. Annexure C of this agreement also contains limited exceptions in relation to when a landowner is not required to comply with the management actions contained in Annexure C.

### **Cultural heritage**

- 3.2 To avoid any doubt, nothing in this agreement is to be construed as authorising (including, but not limited to, by way of a consent, permit, approval or authorisation of any kind for the purposes of Part 6 of the NPW Act) any person to damage or to cause or permit damage to an Aboriginal object or Aboriginal place in, on or under the biobank site.

### **Obtaining of consents, permits and authorisations**

- 3.3 The landowner is responsible for obtaining all necessary licences, consents, authorisations, permits or approvals in order to lawfully comply with and carry out its obligations under this agreement or to undertake or enable any other identified matter under clause 3.5 and/or clause 3.6.

### **Development**

- 3.4 The landowner must not carry out, or cause or permit to be carried out, any development (as defined under clause 1 above) on the biobank site, unless the development:
- 3.4.1 is permitted or required under Annexure C, or

- 3.4.2 is identified in the table entitled 'Permissible development on the biobank site' contained in clause 3.5 or identified in the table entitled "Permissible human activities on the biobank site' contained in clause 3.6.

### Permissible development

- 3.5 The landowner shall be permitted to carry out, or cause or permit to be carried out, the development specified in the following table in the management zone specified in the table.

Permissible development on the biobank site	
Description of development	Management zone/s
Carrying out of any activity subject to Petroleum Exploration Licence 2 of the <i>Petroleum (Onshore) Act 1991</i> or any other petroleum title that may be granted under that Act.	All
Upgrading and/or maintenance of fire trails and access roads as required. Upgrading and maintenance of the fire trails and access roads must be to the existing width and in the existing locations only unless written consent of the Director General has been obtained.	All

### Permissible human activities

- 3.6 Notwithstanding clause 3.1, the landowner may carry out or cause or permit to be carried out any human activities specified in the following table, in the management zone specified in the table.

Permissible human activities on the biobank site	
Description of human activities	Management zone/s
Passive recreation, with the exception of overnight stays, is permissible on the land to the extent that the condition of vegetation on site is not degraded. Passive recreation can include but is not limited to activities such as walking and bird watching.	All
Use of motorised vehicles is permitted for undertaking the management actions in accordance with this agreement.	All

## 4 Management actions and management plans

- 4.1 The landowner must carry out or procure the carrying out of the management actions in accordance with the timing, manner and requirements of Annexure C.
- 4.2 The landowner must:
- implement or procure the implementation of; and
  - comply or procure the compliance with

the management plans in accordance with the timing, manner and requirements of Annexure C.

Note: The management actions listed in Annexure C include requirements to take certain action and requirements to refrain from taking certain action.

4.3 Unless otherwise indicated by Annexure C, the landowner must ensure that

- a. the management actions to be carried out in accordance with clause 4.1; and
- b. the management plans to be implemented and complied with in accordance with clause 4.2

are carried out in perpetuity, commencing from the date indicated in Annexure C.

4.4 The landowner's obligations under this clause are subject to clause 12.4 of this agreement.

## 5 Total Fund Deposit

For the purpose of clause 26 of the BioBanking Regulation, the Total Fund Deposit for this biobank site is \$546,329 excluding GST, determined in accordance with Part 6 of the BioBanking Regulation.

Note: Part 6 of the BioBanking Regulation prescribes the amount that must be deposited in the BioBanking Trust Fund before the first transfer (or retirement without transfer) of each biodiversity credit can be registered. The prescribed amount is the Total Fund Deposit, or proportion thereof if a partial sale of credits is made. The Total Fund Deposit is the present value of the total of all management payments listed under this agreement, as determined by the Director General.

## 6 Biodiversity credits

6.1 The Director General is permitted under section 127W(4) of the Act, to create (without application by the landowner under section 127W(4) of the Act) the biodiversity credits listed in Annexure B on the commencement of this agreement.

6.2 The biodiversity credits listed in Annexure B will be created for this biobank site.

6.3 Upon signing the agreement, the landowner is entitled to receive \$750,000 excluding GST, to be satisfied in full by the creation of the biodiversity credits listed in Annexure B.

Note: \$750,000 is a best estimate of the market value of the biodiversity credits at the time of creation. The market value has been estimated by reference to the notional Part B amount as determined by the landowner in the credit pricing spreadsheet or reference to the notional Part B amount for the last traded biodiversity credit of the same or similar type.

The Part B amount is that part of the sale price received by the landowner (or another landowner if reference is made to a previous sale of that biodiversity credit type) after the entire Total Fund Deposit is satisfied and deposited into the BioBanking Trust Fund.

The sale price of each biodiversity credit will be negotiated between the landowner and the buyer and will be affected by supply and demand for each biodiversity credit. The final price at the time of transfer of the biodiversity credit (or retirement or the biodiversity credit without transfer) may not reflect this estimated amount.

The Minister does not warrant that the landowner will be able to sell biodiversity credits for the estimated market value.

## **7 Monitoring, record keeping and reporting**

- 7.1 The landowner must comply with the monitoring and record keeping requirements set out in Annexure D.
- 7.2 The landowner must submit an annual report complying with the requirements set out in Annexure D to the Director General within the timeframe specified in Annexure D.
- 7.3 The landowner must notify the Director General in writing as soon as practicable after becoming aware of any failure to comply with this agreement or any other incident at the biobank site (or surrounds) which results or may result in a sudden or significant decline of biodiversity values at the biobank site. In particular, the landowner must notify the Director General of:
  - 7.3.1 the nature, location and time of the incident
  - 7.3.2 the impact of the incident on biodiversity values
  - 7.3.3 the measures that have been taken or will be taken in response to the incident
  - 7.3.4 any provision of this agreement which may have been breached
  - 7.3.5 the extent of any damage caused or permitted by the incident
  - 7.3.6 the measures which have been taken or will be taken to prevent a recurrence of the incident.

## **8 Use of the land by servants, agents, lessees or licensees**

The landowner must incorporate all relevant requirements of this agreement in any lease or licence issued for the biobank site, and must at all times ensure that any servant, contractor, consultant, agent, lessee or licensee occupying the biobank site area shall be aware of, and not undertake any act inconsistent with, the landowner's obligation under this agreement.

## **9 Change of land ownership or subdivision of land**

- 9.1 The landowner must notify the Director General in writing of any change of:
  - 9.1.1 ownership of the biobank site, or any part thereof, within seven (7) days after the change of ownership of the biobank site; or
  - 9.1.2 lessee of the biobank site, or any part thereof, within twenty eight (28) days after the change of lessee or licensee of the biobank site.

The notice must include the name and address of the new landowner, lessee or licensee.

- 9.2 The landowner must provide a copy of this agreement, including a copy of each approved management plan and a copy of all records required to be kept under the record keeping requirements, to the transferee before completion of the assignment, transfer, disposal or sale of any interest in the land comprising the biobank site.

- 9.3 The landowner must notify the Director General in writing no less than 14 days before land is subdivided.
- 9.4 The landowner cannot assign, transfer, dispose of or sell its rights, title or interest in part of the land containing any area of the biobank site unless the landowner and the Minister have first agreed to vary the agreement to apportion the obligations and rights under the agreement in respect of that part of the biobank site that will be assigned, transferred, disposed of or sold.

## **10 Right to enter biobank site for research and monitoring**

- 10.1 The landowner must permit access to the biobank site at any time to the Minister, the Director General, an authorised officer or an officer of OEH for the purpose of carrying out research or monitoring in relation to the biodiversity values on the biobank site for which biodiversity credits have been created under this agreement, but only where the person has given reasonable notice to the landowner and the landowner's agent, lessee or licensee, of the intention to enter the biobank site for that purpose and the nature of the research or monitoring that will be conducted. In exercising its right of access under this clause, the Minister, the Director General, an authorised officer or an officer of OEH must ensure that such access does not:
- 10.1.1 result in physical or radio interference which obstructs, interrupts or impedes the use or operation of any telecommunications network and telecommunications service of a lessee or licensee of a part of the land; or
  - 10.1.2 Interfere with the electricity supply separate from the landowner's electricity supply to any part of the land occupied by a lessee or licensee.
- 10.2 The Minister, Director General, an authorised officer or an officer of OEH may make a written request to the landowner to consent to any other person specified in the written request to enter the biobank site for the purpose of carrying out the research or monitoring referred to in clause 9.1, whether or not that person will accompany the Minister, Director General, an authorised officer or an officer of OEH. The landowner will not unreasonably withhold consent.
- 10.3 Clauses 10.1 and 10.2 do not affect or limit the powers of authorised officers under the NPW Act to enter premises for the purpose of determining whether there has been compliance with, or contravention of, this agreement.

## **11 Agreement preparation expenses**

Each party bears its own costs connected with the preparation and execution of this agreement.

## **12 Obligations of the Minister**

- 12.1 Subject to clauses 12.2 and 12.3 and starting from the date the balance in the biobank site account is equal to or greater than 80% of the Total Fund Deposit for the first time, the Minister is required to direct the fund manager to make such management payments specified in the payment schedules from the relevant biobank site account to the landowner, at such intervals specified in the payment schedules.

12.2 The Minister may only make such a direction if:

- 12.2.1 the relevant biobank site account has sufficient funds to cover the management payment, and
- 12.2.2 the landowner has submitted the annual report for the preceding reporting period in accordance with clause 7.2 and Annexure D of this agreement, and
- 12.2.3 the Minister has reviewed the annual report for the preceding reporting period and is satisfied that the landowner has complied with their obligations set out in this agreement in the preceding period.

12.3 The landowner acknowledges that the Minister may, with the agreement of the landowner, direct that management payments listed in Annexure E should not be made, or should be reduced, for a specified period of time or until further notice if the biobank site account has an operational deficit greater than the operational deficit threshold.

Note: Withholding or lowering payments when funds in the account are below the maximum operational deficit may help to preserve the long-term financial viability of the fund for the landowner.

12.4 If the Minister, with the agreement of the landowner, directs that management payments be reduced or not be made for a specified period of time or until further notice, then:

- 12.4.1 the Minister may, by written agreement with the landowner, suspend or vary any of the landowner's obligations to carry out management actions under this agreement for the same period of time or some other period, and
- 12.4.2 despite clause 4 of this agreement, the landowner's obligations to carry out management actions under this agreement are suspended or varied in accordance with the agreement.

The Minister must not agree to any variation or suspension under this clause unless satisfied that the variation or suspension does not have a negative impact on the biodiversity values protected by the agreement.

12.5 The landowner acknowledges that the Minister may, in addition to the management payments, direct additional payments to be paid from the BioBanking Trust Fund to the landowner, but only in circumstances where the biobank site account has an operational surplus, the operational surplus amount exceeds the maximum operational surplus for the biobank site account, and the amount the Minister directs to be paid does not exceed the difference between the operational surplus amount and the maximum operational surplus.

12.6 All management payments shall be paid into the bank account nominated by the landowner in accordance with the payment schedules.

### 13 Ownership of land and registration of this agreement

The landowner represents and warrants to the Minister that as at the date of this agreement, it is:

- 13.1.1 the legal and beneficial owner of the land; or



- 13.1.2 legally and beneficially entitled to become the owner of the land and will become the legal and beneficial owner of the land, prior to the date that this agreement is to be registered under clause 13.2 of this agreement.
- 13.2 As contemplated by section 127I(1) of the Act, the Minister agrees to notify the Registrar General when this agreement has been entered into, varied or terminated so the Registrar General can register the agreement, variation or termination by making an entry concerning the agreement, variation or termination in the relevant folio of the Register kept under the *Real Property Act* 1900 (NSW) for the land.
- 13.3 The fee to register the agreement in accordance with section 127I(1) of the Act will be taken from the processing fee, except as provided by clause 13.4.
- 13.4 If the landowner elects to identify the exact boundaries of the biobank site on the Deposited Plan for the land, the landowner must bear any additional costs of registration.

## 14 Variation and termination

- 14.1 Subject to clause 14.2, this agreement can only be varied or terminated in accordance with the Act.
- 14.2 The landowner waives any right to request voluntary termination in accordance with subsections 127G(5) and (6) of the Act.
- 14.3 This clause does not affect the ability of the Minister and the landowner to terminate this agreement by consent under section 127G(2)(a) of the Act (including in the circumstances described in subsection 127G(6) of the Act).

Note: Clause 14.2 ensures that the landowner can obtain Commonwealth Government tax advantages that apply to conservation covenants. Those tax advantages would not be available if the right to request termination of the agreement under subsections 127G (5) and (6) of the Act was available.

Subsections 127(5) and (6) of the Act give landowners the right to request termination of the agreement where credits are not sold within 3 months or after 5 years of entering the agreement. The effect of clause 14.2 is that the landowner gives up that right. This is essential as the tax advantages are only available where the Commonwealth Government has conferred conservation covenant status on biobank sites – and a requirement of this status is that the sites will operate permanently.

## 15 Indemnity and release

- 15.1 The landowner agrees to indemnify the protected persons against all expenses, losses, damages and costs that the protected person may sustain or incur as a result, whether directly or indirectly, of carrying out obligations under this agreement.
- 15.2 The indemnity given by the landowner does not cover any loss or damage that is caused by a negligent act or omission of the protected persons, or any loss or damage that is contributed to by a negligent act or omission of the protected persons to the extent of the protected persons' contribution to that loss or damage.
- 15.3 The landowner releases to the full extent permitted by law the protected persons from all claims and demands arising out of or in connection with, or as a consequence of, carrying out of obligations by the landowners under this agreement, or in connection with, or as a consequence of, a direction made by the Minister regarding the payment of management payments to the landowner under this agreement.

- 15.4 The release given by the landowner does not cover any claims and demands in respect of any loss or damage that is caused by a negligent act or omission of the protected persons, or any loss or damage that is contributed to by a negligent act or omission of the protected persons to the extent of the protected persons' contribution to that loss or damage.
- 15.5 It is immaterial to the obligations of the landowner under this clause that a claim or demand arises out of any act, event or thing that the landowner is authorised or obliged to do under this agreement or that any time waiver or other indulgence has been given to the landowner for any such obligation under this agreement.

In clauses 15.1–15.4:

- (i) 'protected person' means:
- (a) the Minister
  - (b) the Director General
  - (c) the employees or officers of the Director General
  - (d) any other person acting under the direction or control of the Minister or Director General for any purpose
  - (e) the Crown in right of the State of New South Wales;
- (ii) 'claims and demands' means all actions, suits, claims, demands, proceedings, losses, compensation, damages, sums of money, costs, legal costs, charges, and expenses to which the protected persons are or may become liable for in respect of loss or damage to the fixtures of the biobank site, financial or economic loss, loss of opportunity or other consequential loss of the landowner, and injury of any kind to or death of any person claiming through the landowner and however sustained on or outside the biobank site.

## **16 Dispute resolution**

- 16.1 Where there is a dispute, difference or claim (dispute), the party raising the dispute must notify the other party in writing of the nature of the dispute, including the factual and legal basis of the dispute.
- 16.2 Within 14 days of the written notice, the Director General and the landowner, or nominated senior representatives of the parties, must confer to attempt to resolve the dispute, and if the dispute cannot be resolved within twenty-one (21) days of the written notice, the Director General and the landowner will refer the matter to mediation.
- 16.3 The parties will agree on the terms of appointment of the mediator and the terms of the mediation in writing within twenty-eight (28) days, failing which the mediation will be at an end and either party may commence court proceedings in respect of the dispute, difference or claim.
- 16.4 If the matter has not been resolved within 28 days of the appointment of the mediator, the mediation process will be at an end and either party may commence court proceedings in respect of the dispute, difference or claim.
- 16.5 Notwithstanding the above clauses, the Minister, the Director General or a person duly authorised by the Director General, may enforce this agreement under the Act,

or institute proceedings without first entering into the dispute resolution procedure set out in clauses 16.1, 16.2, 16.3, and 16.4.

- 16.6 Clause 10.1 of this agreement is not affected by these arrangements for dispute resolution.

## 17 Governing law

This agreement is governed by the laws of the State of New South Wales and the parties agree to submit to the jurisdiction of the courts of that State.

## 18 Commencement

This agreement shall have effect from the day it is executed by all parties.

## 19 Privacy statement

The landowner acknowledges and consents to the information contained in this agreement being made publicly available on the biobanking agreements register and, where credits have been registered, on the biobanking credits register maintained by the Director General and made available on the web.

Note: In accordance with the *Privacy and Personal Information Protection Act 1998* and the Act, some of the information contained in this agreement cannot be made available to the public.

## 20 Exercise of Minister's and Director General's powers

- 20.1 The landowner acknowledges that the Minister may authorise any officer of OEHL to exercise any of the Ministers functions under this agreement on the Ministers behalf.
- 20.2 The landowner acknowledges that the Director General, may authorise any officer of OEHL to do any thing that the Director General for the purposes of this agreement.

## 21 Notices

- 21.1 Any notice, consent, information, application or request that must or may be given or made to a party under this agreement is only given or made if it is in writing and delivered or posted to that party at its address set out below, or faxed to that party at its fax number set out below:

### The Minister

Address	Office of Environment and Heritage PO Box A290 SYDNEY SOUTH NSW 1232
Attention (nominated officer)	Manager, Biodiversity and Vegetation Programs

**Landowner**

Address	Waste Assets Management Corporation PO Box 3366 PARRAMATTA NSW 2124
Attention	Planning and Development Manager

21.2 The name or title of the nominated officer or the address for the Minister referred to in clause 21.1 above may be updated from time to time by a further written notice being sent to the landowner by an officer of OEH advising of the new officer (or title of an office) and address to which such documents, information or notification may be sent.

21.3 For the avoidance of doubt, this clause does not fetter the Minister or Director General's discretion to give or withhold from giving such notice, consent or permission.

**Agreement annexures**

Annexure A Maps of biobank site

Annexure B Biobanking Agreement Credit Report

Annexure C Management actions and management plans (also approved by the Chief Executive as a Property Management Plan prepared by the landowner under the Section 113B of the *Threatened Species Conservation Act 1995*)

Annexure D Monitoring, reporting and record keeping requirements (also approved by the Chief Executive as a Property Management Plan prepared by the landowner under the Section 113B of the *Threatened Species Conservation Act 1995*)

Annexure E Payment schedules

**In witness where of** the parties hereto have executed this agreement the day and year first above written.

**Signed by**  
**Sally Barnes**, Acting Chief Executive, Office of  
Environment and Heritage (OEH), Department of  
Premier and Cabinet, as the Minister's delegate in  
the presence of:

\_\_\_\_\_  
**Sally Barnes**

\_\_\_\_\_  
Date

\_\_\_\_\_  
Witness signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Witness name

\_\_\_\_\_  
Witness address

**Signed by the landowner**

\_\_\_\_\_  
Phil Carbins, Chief Executive, Waste Assets  
Management Corporation

\_\_\_\_\_  
Date:

\_\_\_\_\_  
In the presence of:

\_\_\_\_\_

\_\_\_\_\_  
In the presence of:

\_\_\_\_\_  
Witness signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Witness signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Witness name

\_\_\_\_\_  
Witness name

\_\_\_\_\_  
Witness address

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Witness address

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\_\_\_\_\_

\_\_\_\_\_

Seal (if signing under seal):

The Chief Executive approves Annexure C and Annexure D as a property management plan prepared by the Landowner under the section 113B of the *Threatened Species Conservation Act, 1995*.

**Signed by**  
**Sally Barnes**, Acting Chief Executive, Office of  
Environment and Heritage (OEH), as delegate  
under Section 113B of the *Threatened Species*  
*Conservation Act 1995* in the presence of:

\_\_\_\_\_  
**Sally Barnes**

\_\_\_\_\_  
Date

\_\_\_\_\_  
Witness signature

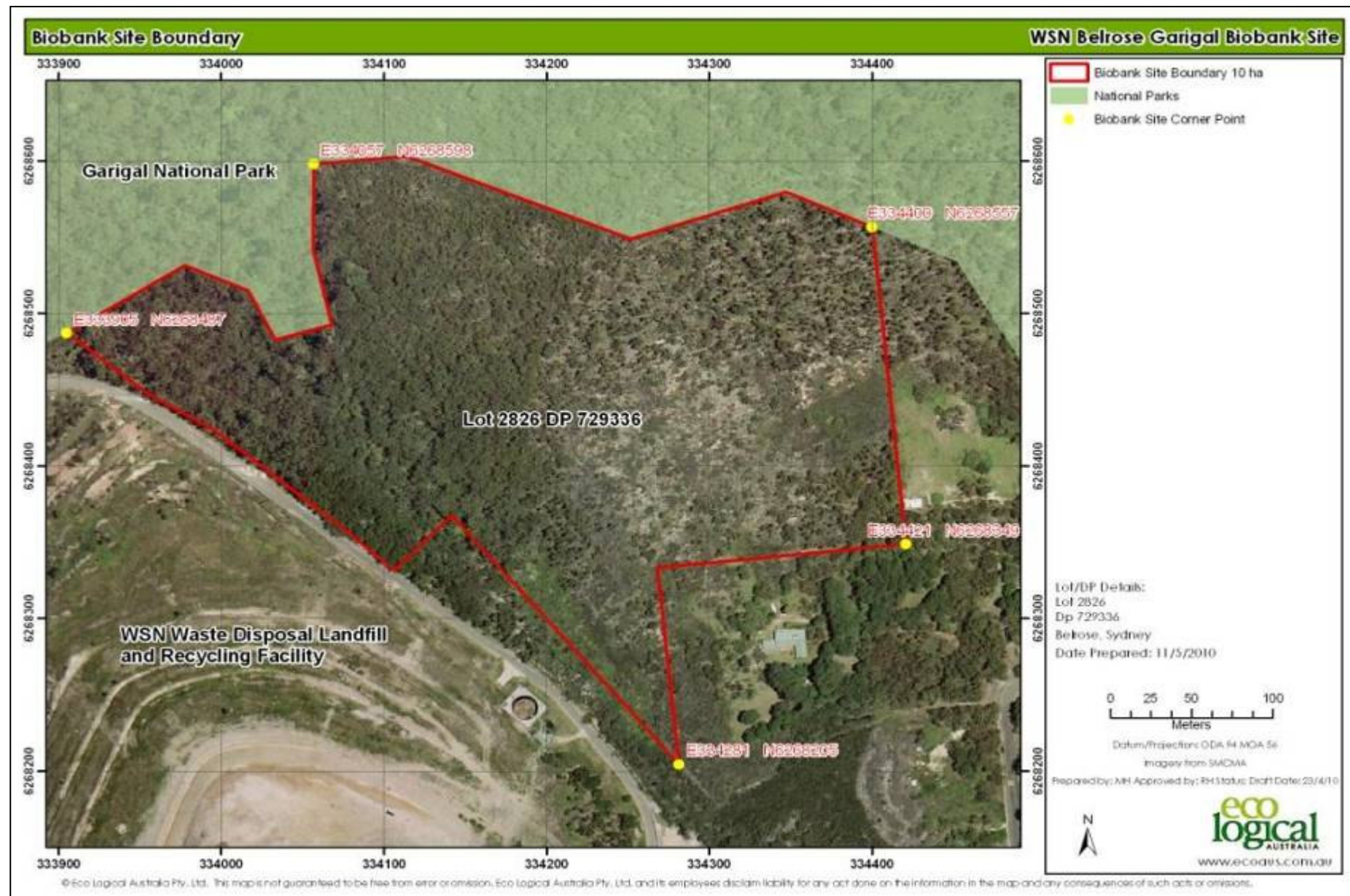
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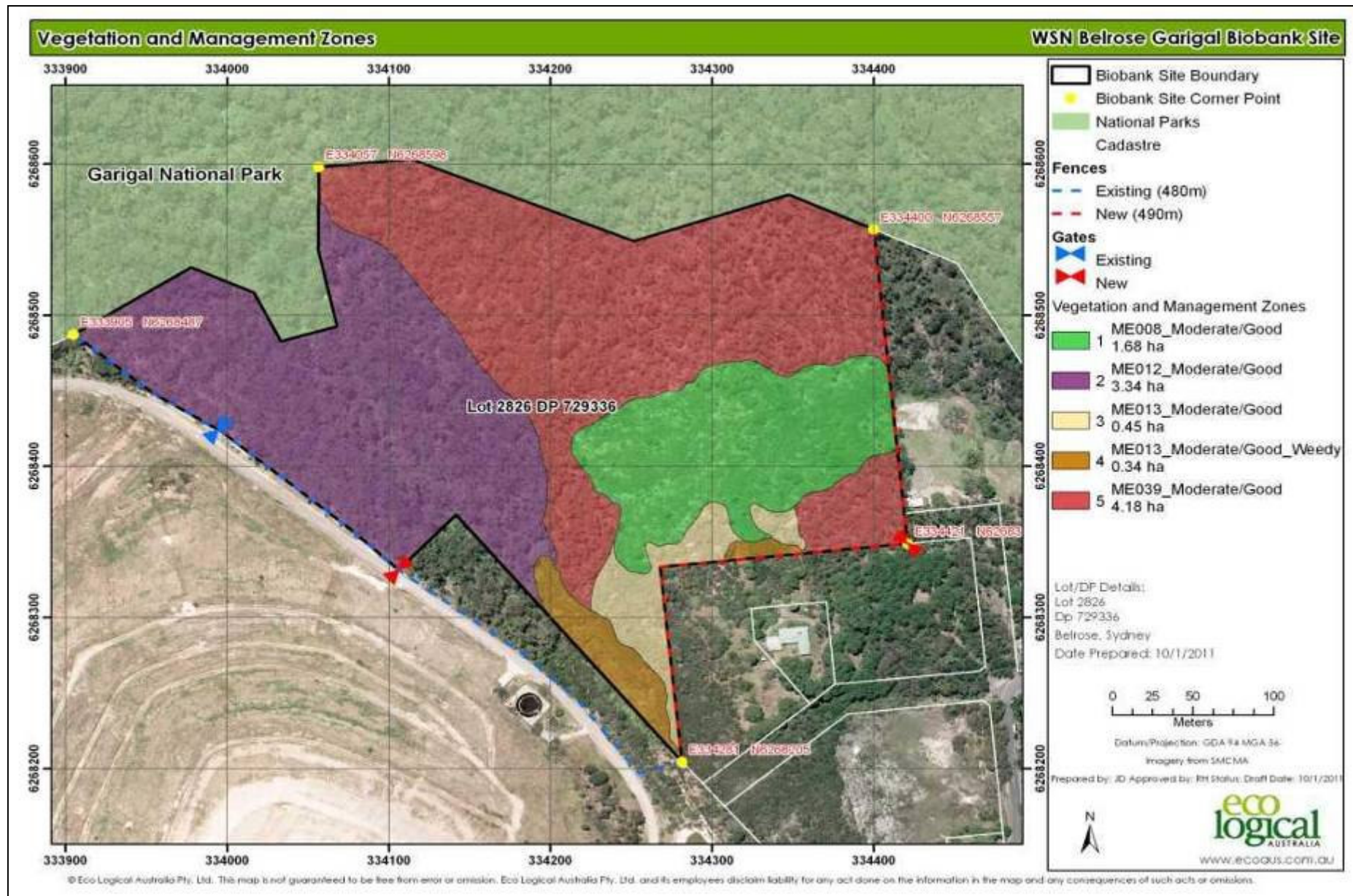
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Witness address

**Annexure A: Maps of biobank site**

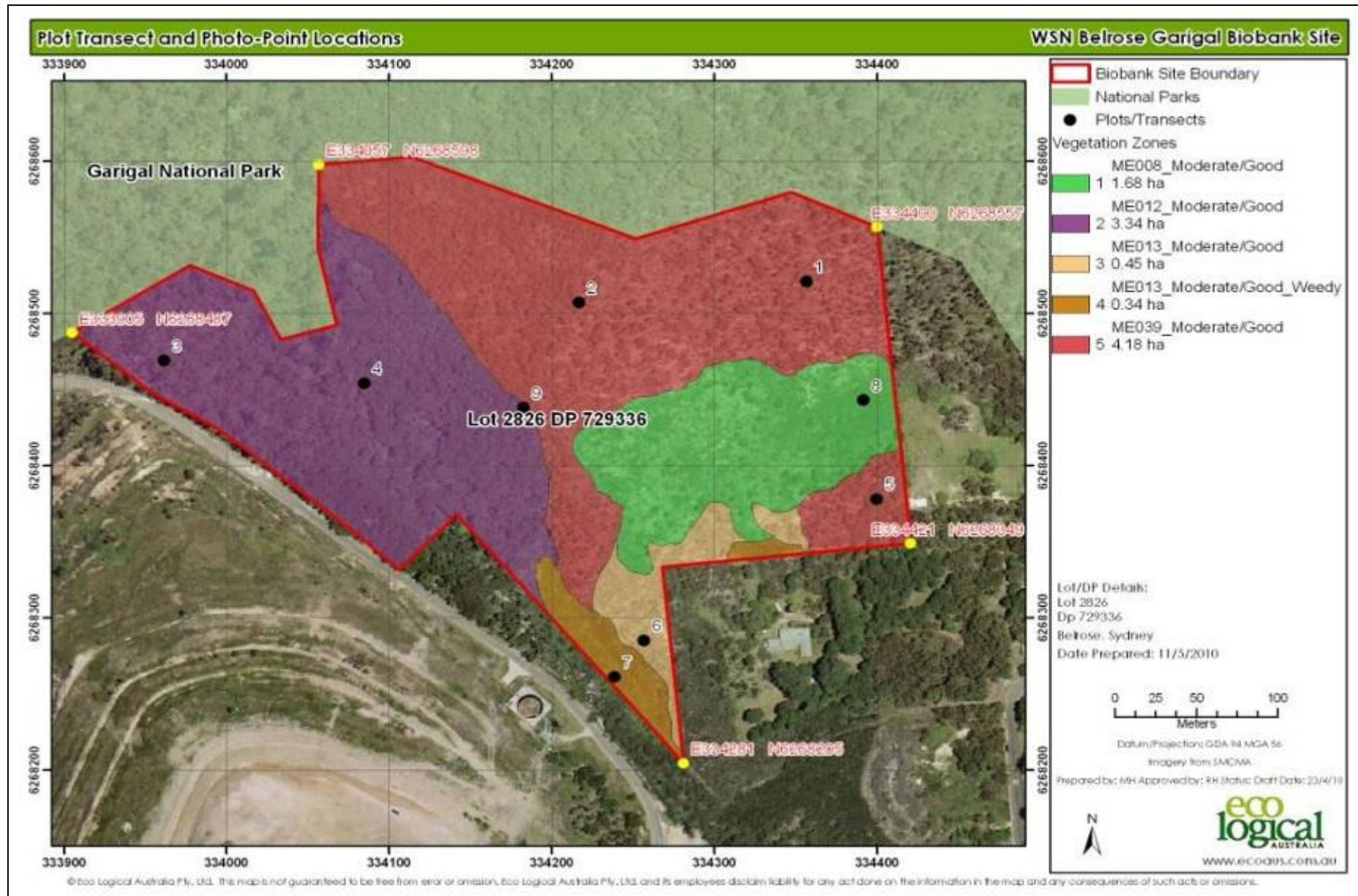




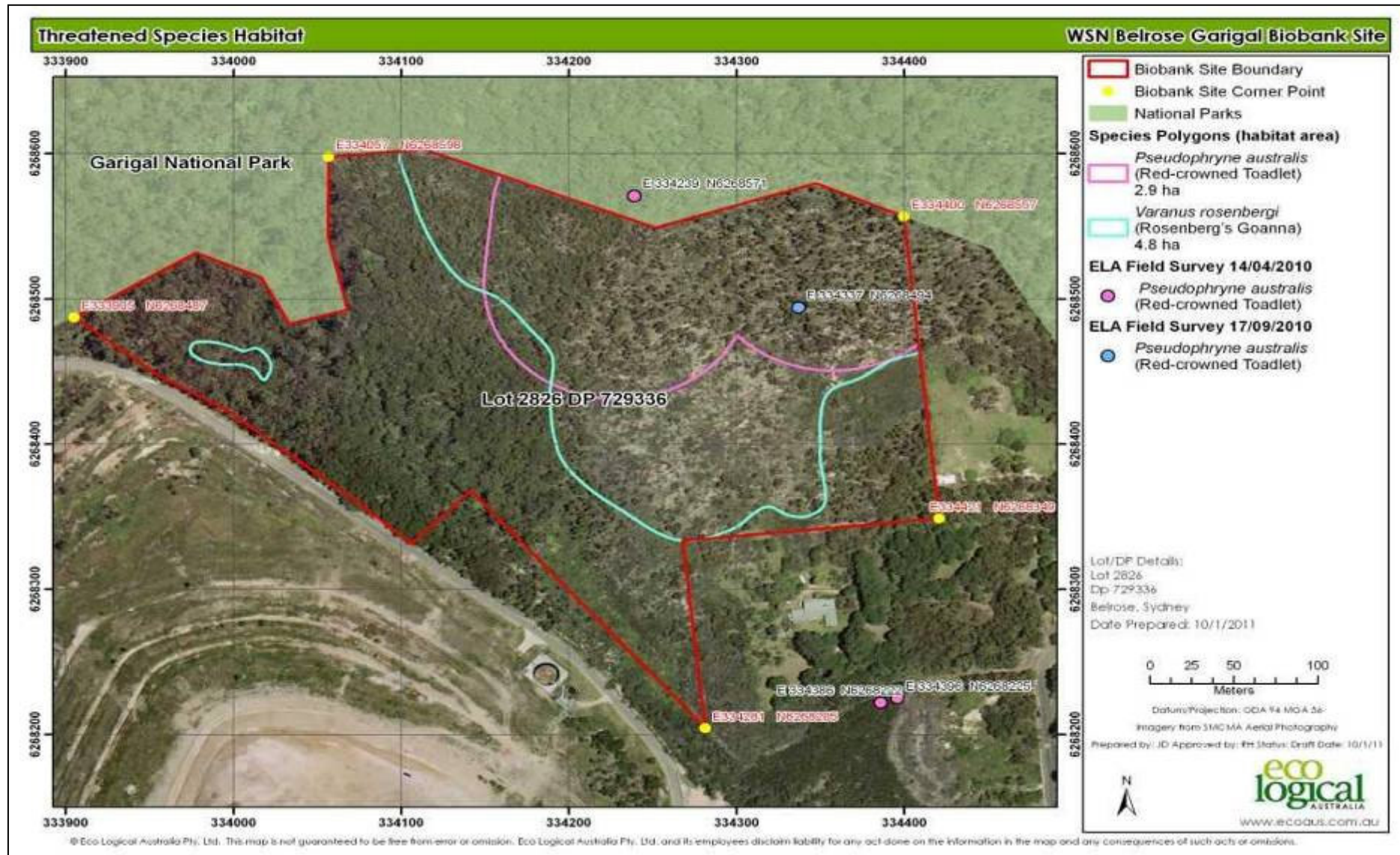












## Annexure B: Biobanking Agreement Credit Report



### ***Biobanking Agreement Credit Report***

This report identifies the number and type of credits that may be created at a BIOBANK SITE.

Date of report: 03/05/2011 Time: 13:42 Tool Version: 1.2

#### **Property Details**

**Proposal ID:** 2010/0027/B003  
**Biobank Name:** Belrose Garigal biobank site  
**Biobank Location:** Belrose, Warringah Local Government Area, Sydney  
**Biobank Address:** Crozier Road, Belrose, NSW  
**Lot:** 2826 **Section:** **DP:** 729336  
**CMA:** Sydney Metro  
**Landholder Name:** Waste Assets Management Corporation  
**Landholder Address:** PO Box 3260 Rhodes NSW 2138  
**Landholder Phone:** (02) 9934 7046  
**Assessor Name:** [REDACTED]  
**Assessor Address:** [REDACTED]  
**Assessor Phone:** [REDACTED]  
**Assessor Accreditation:** [REDACTED]

The following information is required to be submitted with this BioBanking Agreement (where ticked)

- ☐ All or part of the biobank site is covered by a covenant, has received govt funding or is crown land
- ☐ Local reference data is required for the following vegetation zones
- ☒ Expert Report for the following species:
  - Varanus rosenbergi Rosenberg's Goanna
  - Pseudophryne australis Red-crowned Toadlet
- ☐ Justification for request of additional increase in site value score with management for the following vegetation zones:
- ☐ The minimum number of plots were not entered for the following vegetation zones

## Ecosystem Credits

Vegetation Type	Area (ha)	Credits created
Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin	1.68	12
Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin	3.34	29
Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin	0.45	3
Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin	0.34	3
Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin	4.18	30

## Credit Profile

### Group 1 : Ecosystem credits: 12 credits

p

CMA	Sydney Metro
CMA Sub-region	Pittwater (Part B) (201)
Vegetation type	Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin
Surrounding vegetation cover class	31-70%
Patch size, including low condition	>100 ha

Total area of Vegetation zone(s) included in this group: 1.68 ha

### Group 2 : Ecosystem credits: 3 credits

p

CMA	Sydney Metro
CMA Sub-region	Pittwater (Part B) (201)
Vegetation type	Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin
Surrounding vegetation cover class	31-70%
Patch size, including low condition	>100 ha

Total area of Vegetation zone(s) included in this group: 0.45 ha

### Group 3 : Ecosystem credits: 3 credits

p

CMA	Sydney Metro
CMA Sub-region	Pittwater (Part B) (201)
Vegetation type	Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin
Surrounding vegetation cover class	31-70%
Patch size, including low condition	>100 ha

Total area of Vegetation zone(s) included in this group: 0.34 ha

**Group 4 : Ecosystem credits: 30 credits**  
**p**

<b>CMA</b>	Sydney Metro
<b>CMA Sub-region</b>	Pittwater (Part B) (201)
<b>Vegetation type</b>	Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin
<b>Surrounding vegetation cover class</b>	31-70%
<b>Patch size, including low condition</b>	>100 ha

Total area of Vegetation zone(s) included in this group: 4.18 ha

**Group 5 : Ecosystem credits: 29 credits**  
**p**

<b>CMA</b>	Sydney Metro
<b>CMA Sub-region</b>	Pittwater (Part B) (201)
<b>Vegetation type</b>	Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin
<b>Surrounding vegetation cover class</b>	31-70%
<b>Patch size, including low condition</b>	>100 ha

Total area of Vegetation zone(s) included in this group: 3.34 ha



## Species Credits

The property is capable of creating species credits for 2 species.

<b>Red-crowned Toadlet</b>	<b><i>Pseudophryne australis</i></b>
Number of Species Credits capable of being created:	<b>17 Credits</b>
Area of habitat:	2.9 ha
<b>Rosenberg's Goanna</b>	<b><i>Varanus rosenbergi</i></b>
Number of Species Credits capable of being created:	<b>29 Credits</b>
Area of habitat:	4.8 ha

## Additional Management Actions

The following management actions are required at the property. These actions are in addition to the standard management actions required at the property

<b>Cat and/or Fox control</b>	
Rosenberg's Goanna	4.8 ha
<b>Maintain or reintroduce flow regimes (aquatic flora)</b>	
Red-crowned Toadlet	2.9 ha
<b>Cat and/or Fox control</b>	
Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin (ME008)	1.68 ha
Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin (ME013)	0.34 ha
Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin (ME013)	0.45 ha
Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin (ME039)	4.18 ha
Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin (ME012)	3.34 ha
<b>Exclude miscellaneous feral species</b>	
Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin (ME013)	0.34 ha
Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin (ME013)	0.45 ha
Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin (ME039)	4.18 ha
Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin (ME012)	3.34 ha



**Feral and/or native herbivore control/ exclusion (eg rabbit, goats, deer etc)**

Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin (ME008)	1.68 ha
Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin (ME013)	0.34 ha
Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin (ME013)	0.45 ha
Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin (ME039)	4.18 ha
Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin (ME012)	3.34 ha

## Annexure C: Management actions for the biobank site

*This Annexure C, together with Annexure D, is approved as a property management plan prepared by the landowner under the section 113B of the Threatened Species Conservation Act 1995.*

### A Management actions

A1 The landowner must undertake, or cause to be undertaken, the Management Actions contained in the following tables in this Annexure C:

- (i) Section 1: Standard management actions (**'Section 1'**); and
- (ii) Section 2: Additional management actions (**'Section 2'**)

in accordance with the conditions specified in Section 1 and Section 2 and within the timeframes (if any) specified in Section 1 and Section 2.

A2 In carrying out the management actions, the landowner must implement and, at all relevant times comply with, the management plans as contained in the following tables in this Annexure C:

- (i) Section 3: Standard management plans (**'Section 3'**); and
- (ii) Section 4: Additional management plans (**'Section 4'**)

in accordance with the conditions specified in those tables and management plans and within the timeframes (if any) specified in Section 3 and Section 4.

A3 Where a management action requires that something must not be done, the landowner must not do that thing and must not cause, authorise or permit any other person to do that thing.

A4 Notwithstanding A1 and A2 above, the landowner is not required to undertake the management actions so described if the action is inconsistent with anything (act or omission) required or authorised to be done by the landowner by or under any of the following:

- A. removal of noxious weeds under the Noxious Weeds Act 1993
- B. the control of noxious animals under the Rural Lands Protection Act 1998
- C. an obligation arising under an eradication order or pest control order under Part 11 of the Rural Lands Protection Act 1998
- D. a direction under section 37A of the State Emergency and Rescue Management Act 1989 in relation to a state of emergency or a direction under section 22A of the State Emergency Service Act 1989
- E. in respect of the *Rural Fires Act 1997*:
  - (a) an emergency fire fighting act within the meaning of that Act
  - (b) emergency bushfire hazard reduction work within the meaning of that Act
  - (c) any notified steps issued to the landowner under section 63 of that Act

- (d) any notice by a local authority under section 66 of that Act to undertake specified bushfire hazard reduction work
  - (e) otherwise as part of any managed bushfire hazard reduction work within the meaning of the *Rural Fires Act 1997* that is carried out in accordance with:
    - i. a current bushfire hazard reduction certificate that applies to the work
    - ii. the provisions of any bushfire code applying to the land specified in the certificate.
- A5 The landowner may make minor alterations to any management actions as part of adaptive management, where the outcomes of monitoring, including documented observations of the landowner or his/her servant, lessee, agent or licensee/s, indicate that the minor alterations to the management actions are required to improve biodiversity values in accordance with the biobanking agreement. The landowner must document the minor alterations made to the management actions and the reasons for the alterations, and retain a record of the documentation and include it in the annual report.
- B Timing for carrying out management actions**
- B1 An obligation to carry out a management action (or implement and comply with a management plan):
  - (i) will commence on the commencement date or first payment date (as indicated); and
  - (ii) must be carried out in perpetuity unless otherwise indicated in Sections 1 to 4 of this Annexure C.
- B2 The landowner must ensure that if a timeframe is specified in Sections 1 to 4, that the management action is carried out within that timeframe.
- B3 For the avoidance of doubt, an obligation to carry out a management action within a specified timeframe continues until the management action has been carried out even if the time for compliance has passed.

## Section 1: Standard management actions

	Standard management actions	Timing
<b>1</b>	<b>Management of grazing for conservation</b>	
1.1	Stock must not be permitted to graze in any area of the biobank site	Ongoing
1.2	This item is not applicable	Ongoing
1.3	This item is not applicable	Ongoing
1.4	If, at any time, the landowner observes stock in any area of the biobank site, other than an area on the biobank site where grazing is permitted, the landowner must take necessary measures to remove the stock from the area immediately.	Ongoing
<b>2</b>	<b>Weed control</b>	
2.1	The landowner must implement and, at all relevant times, comply with the integrated weed management plan included in Section 3 (or such updated integrated weed management plan as has been approved by the Director General under item 2.2 below) ('the weed management plan'). To allow for adaptive management, minor alterations can be made to the implementation of the integrated weed management plan, and recorded in writing in accordance with paragraph 1.4 of this Annexure.	Ongoing, commencing no later than the date the balance in the biobank site account is equal to or greater than 80% of the Total Fund Deposit for the first time.

2.2	<p>The integrated weed management plan must be reviewed at intervals of no less than 4 years and no more than 6 years by an appropriately qualified person. The review is to consider the efficacy of the management actions in the plan and consider the effectiveness of the matters contained in the current plan that are outlined in the dot points below. Notification of the date of the review commencement must be provided to the Director General in writing within 14 days of the commencement of the review. The findings of the review must be submitted to the Director General within 3 months of commencing the review.</p> <p>Where the Director General determines from the review that an update of the plan is required, the Director General will notify the landowner in writing that an update of the plan is required. The landowner must update the plan and submit it to the Director General for approval within 3 months of receiving written notification from the Director General that an update of the plan is required. The revised plan must be prepared by an appropriately qualified person and must cover the matters outlined below and any additional matters specified by the Director General in writing:</p> <ul style="list-style-type: none"> <li>• a description of the target weed/s at the biobank site and their location/s, linked to each management zone where weeds are present</li> <li>• the method/s of weed control in each management zone</li> <li>• the frequency of weed control activities at the site, taking into account management practices where weeds are providing habitat for native species</li> <li>• the timing of any planting of native plant species required in each management zone to provide alternative habitat for native species affected by weed control activities</li> <li>• methods for monitoring the success of weed control activities</li> <li>• a timetable/measures for inspections to identify new weed species or exotic plant species (including noxious weeds under the <i>Noxious Weeds Act 1993</i>)</li> <li>• additional weed control activities to destroy or remove any new weed species that are found on the site</li> <li>• measures for assessing and reporting monitoring results</li> <li>• a diary for recording actions taken in accordance with the integrated weed management plan and minor alterations to this plan permitted for adaptive management. The details (management zone/s, date, alternative action) and reasons for the minor alterations must be recorded in the diary.</li> </ul>	<p>Ongoing commencing no later than the date the balance in the biobank site account is equal to or greater than 80% of the Total Fund Deposit for the first time.</p>
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<b>3</b>	<b>Management of fire for conservation</b>	
3.1	The landowner must implement and at all relevant times, comply with the fire for conservation management plan included at Section 3 (or such updated fire management plan as has been approved by the Director General under item 3.2 below) ('the fire management plan'). To allow for adaptive management and weather conditions, minor alterations can be made to the implementation of the fire management plan, and must be recorded in writing.	Ongoing, commencing no later than the date the balance in the biobank site account is equal to or greater than 80% of the Total Fund Deposit for the first time
3.2	<p>The fire management plan must be reviewed at intervals of no less than 4 years and no more than 6 years by an appropriately qualified person. The review is to consider the efficacy of the management actions in the plan and consider the effectiveness of the matters contained in the current plan that are outlined in the dot points below. Notification of the date of the review commencement must be provided to the Director General in writing within 14 days of the commencement of the review. The findings of the review must be submitted to the Director General within 3 months of commencing the review.</p> <p>Where the Director General determines from the review that an update of the plan is required, the Director General will notify the landowner in writing that an update of the plan is required. The landowner must update the plan and submit it to the Director General for approval within 3 months of receiving written notification from the Director General that an update of the plan is required. The revised fire management plan must be prepared by an appropriately qualified person and cover the matters outlined below and any additional matters specified by the Director General in writing:</p> <ul style="list-style-type: none"> <li>• the year the last fire went through, the type of fire and the extent of the fire and location, where known</li> <li>• frequency of natural fires in the area of the biobank site, where known</li> <li>• a description of locations and management zones where ecological burns will be conducted and areas that will not be burnt</li> <li>• the methods that will be used for ecological burns</li> <li>• the fire frequency intervals recommended for the vegetation types and threatened species present, including any required adjustment to the schedule in the event of a wildfire or activities undertaken under the <i>Rural Fires Act 1997</i> to ensure minimum frequency between ecological burns</li> <li>• the fire intensity for the recommended vegetation types</li> <li>• the time of year suitable for ecological burns</li> <li>• the diary for recording actions taken in accordance with the fire management plan and minor alterations to this plan permitted for adaptive management. The details (management zone/s, date, alternative action) and reasons for the minor alterations must be recorded in the diary.</li> </ul>	Ongoing, commencing no later than the date the balance in the biobank site account is equal to or greater than 80% of the Total Fund Deposit for the first time
3.3	Fires must not be lit on the biobank site other than for the purpose of ecological burning in accordance with the approved	Ongoing

	fire management plan or as permitted as a permissible human activity on the biobank site under item 4 below or clause 2 of this agreement.	
<b>4</b>	<b>Management of human disturbance</b>	
4.1	Except as permitted under clause 2.6 of the agreement or item 4.2 below, human activities that adversely affect biodiversity values on the biobank site, including repeated disturbance of native animals, must not be carried out, or caused or permitted to be carried out, on the biobank site.	Ongoing
4.2	Human activities that may have a negative impact on biodiversity values on the biobank site are permitted if they are listed as permissible activities under clause 2.6 of the agreement or if they are undertaken as part of the management actions.	Ongoing
4.3	This item is not applicable	
4.4	<p>The landowner must not:</p> <ul style="list-style-type: none"> <li>store or dispose of, or</li> <li>cause or permit to be stored or disposed of, any waste on the biobank site.</li> </ul> <p>Note: The storage or disposal of waste on the biobank site may require an approval under the <i>Protection of the Environment Operations Act 1997</i>.</p>	Ongoing
4.5	All reasonable steps must be taken to remove waste deposited by others on the biobank site, or which is otherwise present on the biobank site.	Ongoing, commencing no later than the date the balance in the biobank site account is equal to or greater than 80% of the Total Fund Deposit for the first time
4.6	<p><b>Fencing and signage</b></p> <p>The landowner must install and maintain new fencing and signage along the entire length of the boundary of the biobank site as shown marked "Fences – New (490m)" on the vegetation and management zones map, within 12 months.</p> <p>In particular:</p> <ul style="list-style-type: none"> <li>the fencing must be cyclone wire or cables</li> <li>the biobank site signage must be purchased from OEH; and</li> <li>one sign must be fixed onto each of the existing and new gates as shown marked "Gates – Existing" and "Gates - New" on the vegetation and management zones maps within 12 months.</li> </ul> <p>The landowner must maintain existing fencing and signage on the western boundary of the biobank site as shown marked "Fences – Existing (480m)" on the vegetation and management zones map to deter waste dumping, inappropriate access and unauthorised grazing on the biobank site.</p> <p>Signage must be replaced when the writing or images on the sign</p>	Ongoing, commencing no later than the date the balance in the biobank site account is equal to or greater than 80% of the Total Fund Deposit for the first time

	<p>are no longer clearly visible or are illegible.</p> <p><b>Gates</b></p> <p>The landowner must install and maintain the new gates identified on the vegetation and management zones map as “Gates – New” within 12 months (‘the new gates’).</p> <p>The new gates must be stock proof.</p> <p>The landowner must maintain the existing gates identified on the vegetation and management zones map as “Gates – Existing”.</p> <p><b>Access to biobank site</b></p> <p>Prior approval for any access onto the biobank site or any human activities (as permissible under clause 2.6 of the agreement) on the biobank site must be obtained from the property manager appointed by the landowner to manage the biobank site and be in accordance with the terms of this agreement.</p>	
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<b>5</b>	<b>Retention of regrowth and remnant native vegetation</b>	
	Note: An approval under the <i>Native Vegetation Act 2003</i> may be required to carry out thinning or any other removal or damage to vegetation under this clause.	
5.1	Native vegetation (whether remnant or regrowth) on the biobank site must not be cut down, felled, thinned, logged, killed, destroyed, poisoned, ringbarked, uprooted, burnt or otherwise removed, except: <ul style="list-style-type: none"> <li>• in accordance with items 5.2 and 5.3 below, or</li> <li>• if it is required as part of the management actions, or</li> <li>• it is essential for the carrying out of permissible development under clause 2.5 of the agreement.</li> </ul>	Ongoing
5.2	Native vegetation on the biobank site must not be burnt except in accordance with the fire management plan prepared pursuant to item 3.1 of this Section 3.	Ongoing
5.3	Native vegetation on the biobank site may be managed to improve biodiversity values by thinning to benchmark stem densities over no more than 80% of each management zone.  Benchmark stem densities has the same meaning as defined in the Vegetation Benchmark Database as published by OEH and updated from time to time.	When required
<b>6.0</b>	<b>Replanting or supplementary planting where natural regeneration will not be sufficient</b>	
6.1	This item is not applicable	
6.2	This item is not applicable	
6.3	This item is not applicable	
6.4	This item is not applicable	
6.5	This item is not applicable	

## 6.6 Planting schedule at the biobank site

Species' common name	Species' scientific name	Management zone/s of planting	Number of plants per area	Planting method	Timing (months)
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<b>7</b>	<b>Retention of dead timber</b>	
7.1	<p>Dead timber (whether standing or fallen and including branches and leaf litter) must not be removed from or moved within the biobank site except for the personal (non-commercial) use by the landowner for firewood for one dwelling only or for repair of fencing (not for construction of fencing).</p> <p>Dead timber used for fencing repair must be documented by the landowner in writing and records must be kept in accordance with the record keeping requirements. The landowner must record the approximate amount of dead timber collected from the biobank site for use in fencing, the location that that dead timber was collected from and the date it was collected (month, year).</p>	Ongoing
7.2	<p>Timber from outside the biobank site may be introduced to and placed on the biobank site to improve biodiversity values. Once the timber has been brought onto the site, it is subject to the requirements of item 7.1 above.</p> <p>Timber brought from outside the biobank site must be documented by the landowner in writing and records must be kept in accordance with the record keeping requirements. The landowner must record the approximate amount of timber brought from outside the biobank site, the location where the timber was placed on the biobank site and the date on which it was placed (month, year).</p>	When required but not required before the date the balance in the biobank site account is equal to or greater than 80% of the Total Fund Deposit for the first time
<b>8</b>	<b>Erosion control</b>	
8.1	<p>All reasonable steps must be undertaken to prevent, control and remedy erosion on the biobank site.</p> <p>Soil management for preventing and controlling erosion is to be undertaken using best practice management, such as that developed by the Soil Conservation Service, applied as relevant for the biobank site.</p>	Commencing no later than the date the balance in the biobank site account is equal to or greater than 80% of the Total Fund Deposit for the first time

<b>9</b>	<b>Retention of rocks</b>	
9.1	The landowner must not remove, or cause or permit to be removed, rocks from the biobank site or move, or cause or permit to be moved, rocks within the biobank site.	Ongoing
9.2	Rocks from outside the biobank site may be placed on the biobank site to improve habitat for threatened species. Rocks, once placed on the biobank site, are subject to item 9.1 above. The landowner must make and retain records of the location of the rocks placed on the site and the date the rocks were brought onto the biobank site in accordance with the record keeping requirements.	When required but not required before the date the balance in the biobank site account is equal to or greater than 80% of the Total Fund Deposit for the first time

## Section 2: Additional management actions

	Additional management actions	Timing
<b>10</b>	<b>Control of feral and overabundant native herbivores</b>	
10.1	<p>The landowner must implement and, at all relevant times, comply with the management plan to control feral and overabundant native herbivores included in Section 4 of this Annexure (or such updated management plan as has been approved by the Director General under item 10.2 below) ('management plan for feral and overabundant native herbivores'). To allow for adaptive management, minor alterations can be made to the implementation of the management plan for feral and overabundant native herbivores, which must be recorded in writing.</p> <p>Note: A licence under Section 121 of the <i>National Parks and Wildlife Act 1974</i> may be required to control overabundant native herbivores.</p>	Ongoing, commencing no later than the date the balance in the biobank site account is equal to or greater than 80% of the Total Fund Deposit for the first time
10.2	<p>The management plan for feral and overabundant native herbivores must be reviewed at intervals of no less than 4 years and no more than 6 years. The review is to consider the efficacy of the management actions in the plan and consider the effectiveness of the matters contained in the current plan that are outlined in the dot points below. Notification of the date of the review commencement must be provided to the Director General in writing within 14 days of the commencement of the review. The findings of the review must be submitted to the Director General within 3 months of commencing the review.</p> <p>Where the Director General determines from the review that an update of the plan is required, the Director General will notify the landowner in writing that an update of the plan is required and the landowner must update the plan and submit the amended plan to the Director General for approval within 3 months of receiving written notification from the Director General that an update of the plan is required. The revised plan must cover the matters outlined below and any additional matters specified by the Director General in writing:</p> <ul style="list-style-type: none"> <li>• a description of the feral or overabundant native herbivore/s</li> <li>• consideration of relevant current OEH and other pest management programs and methods</li> <li>• the method/s for feral and overabundant native herbivore control in each management zone, determined in accordance with best practice management</li> <li>• the frequency and timing of the control actions in each management zone</li> <li>• methods for monitoring the success of the pest control actions</li> <li>• a timetable and measures for inspections to identify new feral or overabundant native herbivores that may adversely affect</li> </ul>	Ongoing, commencing no later than the date the balance in the biobank site account is equal to or greater than 80% of the Total Fund Deposit for the first time

	<p>biodiversity values on the biobank site</p> <ul style="list-style-type: none"> <li>• additional control actions to destroy or remove any new feral and overabundant native herbivore pest species that occur on site</li> <li>• measures for assessing and reporting monitoring results</li> <li>• a diary for recording actions taken in accordance with the management plan to control feral and overabundant native herbivores and minor alterations to this plan permitted for adaptive management. The details (management zone/s, date, alternative action) and reasons for the minor alterations must be recorded in the diary.</li> </ul>	
<b>11</b>	<b>Vertebrate pest management – (Foxes and cats)</b>	
11.1	<p>The landowner must implement and, at all relevant times, comply with the vertebrate pest management plan included at Section 4 of this Annexure (or such updated vertebrate pest management plan as has been approved by the Director General under item 11.2 below) ('the vertebrate pest management plan'). To allow for adaptive management, minor alterations can be made to the implementation of the vertebrate pest management plan, but these must be recorded in writing.</p>	<p>Ongoing, commencing no later than the date the balance in the biobank site account is equal to or greater than 80% of the Total Fund Deposit for the first time</p>
11.2	<p>The vertebrate pest management plan must be reviewed at intervals of no less than 4 years and no more than 6 years by an appropriately qualified person. The review is to consider the efficacy of the management actions in the plan and consider the effectiveness of the matters contained in the current plan that are outlined in the dot points below. Notification of the review commencement must be provided to the Director General in writing within 14 days of the commencement. The findings of the review must be submitted to the Director General within 3 months of commencing the review.</p> <p>Where the Director General determines from the review that an update of the plan is required, the Director General will notify the landowner in writing that an update of the plan is required. The landowner must update the plan and submit it to the Director General for approval within 3 months of receiving written notification from the Director General that an update of the plan is required. The revised plan must cover the matters outlined below and any additional matters specified by the Director General in writing:</p> <ul style="list-style-type: none"> <li>• a description of the target fauna species e.g. pigs, foxes or other species such as feral dogs or goats</li> <li>• consideration of relevant current OEH and other pest management programs</li> <li>• the method/s of vertebrate pest control in each management zone determined in accordance with best management practice</li> <li>• the frequency and timing of vertebrate pest control actions in each management zone</li> <li>• methods for monitoring the success of vertebrate pest control</li> </ul>	<p>Ongoing, commencing no later than the date the balance in the biobank site account is equal to or greater than 80% of the Total Fund Deposit for the first time</p>

	<p>actions</p> <ul style="list-style-type: none"> <li>• a timetable and measures for inspections to identify new vertebrate pest species that may negatively impact on threatened species on the biobank site</li> <li>• additional vertebrate pest control actions to destroy or remove any new vertebrate pest species that occur on-site</li> <li>• measures for assessing and reporting monitoring results</li> <li>• a diary for recording actions taken in accordance with the vertebrate pest management plan and minor alterations to this plan permitted for adaptive management. The details (management zone/s, date, alternative actions) and reasons for the minor alterations must be recorded in the diary.</li> </ul>	
<b>12</b>	<b>Nutrient control</b>	
12.1	This item is not applicable	
<b>13</b>	<b>Control of exotic fish species</b>	
13.1	This item is not applicable	
<b>14</b>	<b>Maintenance or reintroduction of natural flow regimes</b>	
14.1	This item is not applicable	
14.2	This item is not applicable	
14.3	Artificial structures such as dams or levee banks that impede the natural flow regimes on the biobank site must not be constructed unless approved by the Director General in writing for the purpose of restoring natural flows.	Ongoing

## Section 3: Standard management plans

### Weed management plan

The weed types, description and location (management zone/s) of weed infestations existing at the time of agreement are listed in the weed management plan. The methods of weed control (management actions), monitoring and inspections are also listed.

The landowner must perform the methods of weed control and other weed management activities and monitoring in the weed management plan by the methods described (and in accordance with item 2 of Section 1 of this Annexure) for all weeds. The methods of control will apply to the weeds listed in the table below as well as any other weeds that may be present on the site from time to time.

The template for reporting of monitoring activities and the diary template for weed control management must be filled in to record observations during the implementation of the weed management plan, including any minor variations.

#### Weed types, methods of weed control and monitoring

Weed	Name of target weed	Description of infestation	Management zone/s	Method of Control	Frequency & Timing of Control	Method of monitoring	Monitoring date/s required
A	Pampas Grass	Heavy infestation of mature plants (up to 2m in diameter in MZ4)  Smaller plants scattered throughout site in open areas	Heavy infestation in MZ4 and scattered in MZ5 near grazed area	Weed control will be undertaken in three stages  1. Primary weeding: Initial clearing of all weed species  2. Secondary weeding: careful removal of all weeds re-establishing onsite  3. Follow up weeding: generally an annual	Primary weeding: to be undertaken in the first year  Secondary weeding to be undertaken within 6 months of primary weeding  Follow-up weeding to be undertaken six months after secondary weeding then every 12 months	Record occurrences and control during control activities	Every 12 months

				<p>treatment to maintain the site at the at the highest condition possible</p> <p>The method of weed control for mature plants to comprise of cut and paint rhizome with non-selective herbicide and spray regrowth with non-selective herbicide</p> <p>Smaller plants to be sprayed with non-selective herbicide</p>			
B	Lantana	Minor outbreaks along fence-line on western boundary (MZ2), heavy infestations in MZ4	MZ2 and MZ4	<p>Weed control will be undertaken in three stages</p> <ol style="list-style-type: none"> <li>1. Primary weeding: Initial clearing of all weed species</li> <li>2. Secondary weeding: careful removal of all weeds re-establishing onsite</li> <li>3. Follow up weeding: generally an annual treatment to maintain the site at the at the highest condition possible</li> </ol> <p>Method of control is to comprise of cutting and painting stems of weed with non-selective herbicide</p>	<p>Primary weeding: to be undertaken in the first year</p> <p>Secondary weeding to be undertaken within 6 months of primary weeding</p> <p>Follow-up weeding to be undertaken six months after secondary weeding then every 12 months</p>	Record occurrences and control during control activities	Every 12 months



C	Blackberry	Few plants scattered throughout MZ4	MZ4	Method of control is to comprise of cutting and painting stems of weeds with non-selective herbicide	Weed control to be undertaken between November and March Ongoing	Record occurrences and control during control activities	Every 12 months
D	Cassia	Heavy infestation in MZ4 scattered elsewhere	MZ4	<p>Weed control will be undertaken in three stages</p> <p>1. Primary weeding: Initial clearing of all weed species</p> <p>2. Secondary weeding: careful removal of all weeds re-establishing onsite</p> <p>3. Follow up weeding: generally an annual treatment to maintain the site at the at the highest condition possible</p> <p>Method of control is to comprise of cutting and painting stems of weed with non-selective herbicide</p>	<p>Primary weeding: to be undertaken in the first year</p> <p>Secondary weeding to be undertaken within 6 months of primary weeding</p> <p>Follow-up weeding to be undertaken six months after secondary weeding then every 12 months</p>	Record occurrences and control during control activities	Every 12 months
E	Devils Fig	Scattered plants in MZ4	MZ4	Method of control is to comprise of cutting and painting stems of weeds with non-selective herbicide	Ongoing, whenever detected NOTE: take extreme care with prickles on stem	Record occurrences and control during control activities	Every 12 months
F	Weedy	Moderate infestation in MZ5	All management	Method of control is to	Ongoing, whenever	Record	Every 12

	grasses that favour open edges e.g.:  Whiskey Grass, Pigeon Grass,  <i>Ehrharta erecta</i>	and scattered throughout entire site in open areas	zones	comprise of spraying with a non-selective herbicide or hand-removal as required	detected	occurrences and control during control activities	months
G	Crofton Weed	Moderate infestation	MZ4	<p>Weed control will be undertaken in three stages</p> <ol style="list-style-type: none"> <li>1. Primary weeding: Initial clearing of all weed species</li> <li>2. Secondary weeding: careful removal of all weeds re-establishing onsite</li> <li>3. Follow up weeding: generally an annual treatment to maintain the site at the at the highest condition possible</li> </ol> <p>Method of control is to comprise of cutting back native fern and spraying with non-selective herbicide, or cutting and painting with a non-selective herbicide.</p>	<p>Primary weeding: to be undertaken in the first year</p> <p>Secondary weeding to be undertaken within 6 months of primary weeding</p> <p>Follow-up weeding to be undertaken six months after secondary weeding then every 12 months</p>	Record occurrences and control during control activities	Every 12 months

Template for reporting of monitoring activities		
Management zone/s	Date	<b>Observations and assessment of monitoring</b> This table must include the information for each zone (or groups of zones) which is described in the table titled 'monitoring and inspections of existing and new weeds'.

Diary template for weed control management			
Date	Management zone/s	Description and type of activity undertaken (e.g. weed control, observation)	Minor variations (details and reasons)

## Fire for conservation management plan

The fire for conservation management plan includes information on all known previous fire events in the 'Fire history' table to demonstrate local fire conditions including intensity and frequency.

The ecological fire requirements for each vegetation type or threatened species on the biobank site are listed in the 'Fire requirements for vegetation types and threatened species' table below. These are the fire frequency intervals recommended for the vegetation types and threatened species present on the biobank site. They include any requirement adjustments to the schedule in the event of a wildfire or activities undertaken under the *Rural Fires Act 1997* to ensure the minimum frequencies between ecological burns.

The landowner must carry out ecological burns for each management zone according to the method and frequency described (as informed by the history and requirements sections and in accordance with item 3 of Section 1 of this Annexure). These actions are set out in the 'Ecological burning actions table'. Monitoring and inspections (set out in the 'Fire management monitoring' table below) as described must also be implemented. The landowner must also carry out the actions listed in the 'Other fire management activities' table below.

The table titled 'Template of monitoring activities' below must be completed to record observations during the implementation of the plan and assessment of monitoring activities. The landowner must also complete the table titled 'Diary template for fire management activities' to record the management actions undertaken or observations made, including any minor variations.

### Fire history for previous 20 years (or longer if known)

Year of fire	Hazard reduction, wildfire or ecological burn and extent of fire	Management zone/s
1995	Eastern half of biobank site was burnt including the entire area of MZ1	MZ1 Eastern half of MZ5 Eastern portions of MZ 3 and 4
2004 and 2006	Hazard Reduction burn	Western area of MZ 3 and MZ4

### Fire requirements for vegetation types and threatened species

Vegetation type and/or threatened species	Fire frequency required	Time of year for burning	Fire intensity required	Adjustment required due to wildfires or RFS activities
ME008: Hairpin Banksia – Kunzea ambigua – Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin	10-40 years	March – May or September - November	Moderate to high	Adjust frequency to ensure minimal interval is maintained if a wildfire or hazard reduction burn has occurred
ME012: Sydney Peppermint – Smooth-barked	10-40 years	March – May or September -	Moderate to high	Adjust frequency to ensure minimal interval is

Apple – Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin		November		maintained if a wildfire or hazard reduction burn has occurred
ME013: Hairpin Banksia – Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin	10-40 years	March – May or September - November	Moderate to high	Adjust frequency to ensure minimal interval is maintained if a wildfire or hazard reduction burn has occurred
ME39: Red Bloodwood – Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin	10-40 years	March – May or September - November	Moderate to high	Adjust frequency to ensure minimal interval is maintained if a wildfire or hazard reduction burn has occurred
<b>Ecological burning actions</b>				
Management zone/s	Actions	Supervision & extinguishing techniques	Time of year for burning	Frequency (years)
All	As per the Fire Strategy for Garigal National Park 2007  No fires planned until regeneration of shrubs with woody fruits are sufficiently established and contain a significant proportion of woody fruits	Burns to be guided by the Fire Strategy for Garigal National Park 2007 and scheduled by the Warringah Pittwater Bush Fire Committee	March – May or September - November	As per the Fire Strategy for Garigal National Park 2007  If a wildfire or hazard reduction burn occurs, adjust fire interval to ensure minimum of 10 years
<b>Methods for monitoring the outcomes of ecological burns</b>				
Management zone/s	Method of monitoring	Date/s required		
All	Record and map the areas burnt by any wildfires and any disturbance such as firebreaks established by the RFS in suppressing wildfires	After each fire event		

**Other fire management activities (where required)**

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**Template for reporting of monitoring activities**

Management zone/s	Date	Observations and assessment of monitoring

**Diary template for fire management activities**

Date	Management zone/s	Description of activity undertaken or observation made	Minor variations (details and reasons)

## **Section 4: Additional management plans**

## Management plan to control feral and over abundant herbivores

The management plan for feral and overabundant native herbivores includes information on the management requirements for the feral and overabundant native herbivores at the biobank site listed in the 'Feral and overabundant native herbivores' table below. The possible methods of control for each species, used by OEH and other pest management programs, are listed and the suitability of each method is described in the 'Methods considered' table below.

The landowner must carry out the methods for control for feral and overabundant native herbivores for each management zone according to the method and frequency as described in the 'Methods for control' table below. The methods of control applied to the feral or overabundant native herbivores listed in the 'Feral or overabundant native herbivores' table as well as any other feral or overabundant herbivores that may be present on the site from time to time.

Monitoring and inspections of existing and new feral and overabundant herbivores at the biobank site as described in the 'Monitoring and inspections' table below must be implemented.

The table titled 'Template for reporting of monitoring activities' below must be completed to record observations during the implementation of the management plan for feral and overabundant native herbivores and assessment of the monitoring activities. The landowners must complete the table titled 'Diary template for feral and overabundant herbivore management' to record the management actions undertaken including any minor variations or observations made.

### Feral and overabundant native herbivores

Feral Type	Name of feral/overabundant native herbivore	Description of extent	Management zone/s	Method of control	Frequency & timing of control	Method of monitoring existing and new ferals	Monitoring date/s
A	Rabbits	Occur at low density throughout biobank site, all management zones.	All (MZ1–MZ5)	1. Pindone baits 2. Opportunistic shooting 3. Warren destruction and fumigation  Note: may be done in conjunction with local Council or Garigal National Park	To be determined by a suitably qualified feral animal control specialist in consultation with the landowner in accordance with the terms of any relevant licence issued under the NPW Act  1. Pindone baiting between November -March 2. As required 3. After pindone baiting	Record observations Record amount of bait taken Number of new/active warrens	1. November – March 2. As required 3. As required



Methods considered		
Pest type	Name and description of program or method	Describe suitability
A	OEH/Warringah Council Rabbit Control Program	The effectiveness of any rabbit control program on the biobank site will be enhanced by coordinating management activities with NPWS and/or Warringah Council

Template for reporting of monitoring activities			
Management zone/s	Date	Current level of impact on vegetation This column must record impact as Negligible, Minimal, Moderate or High	Observations and assessment of monitoring

Diary template for feral and overabundant herbivore management			
Date of activity	Management zone/s	Description and type of activity undertaken This column must include details of the feral and overabundant herbivores targeted, control techniques applied and numbers controlled.	Minor variations (details and reasons)

## Vertebrate pest management plan

The vertebrate pests management plan includes information on the vertebrate pests and their extent existing at the time of the agreement as listed in the 'Vertebrate pests' table below. The possible methods of control for each species, used by OEH and other pest management programs are listed and the suitability of each method to the biobank site is described in the 'Methods considered' table below.

The landowner must carry out the methods for vertebrate pest control for each management zone according to the method and frequency described in the 'Methods of control' table below. The methods of control will apply to the vertebrate pests listed in the 'Vertebrate pests' table below as well as any other vertebrate pests that may be present on the site from time to time. Monitoring and inspections of existing and new vertebrate pests on the biobank site, as described in the 'Monitoring and inspections' table below, must be implemented.

The table titled 'Template for reporting of monitoring activities' below must be completed to record observations during the implementation of the vertebrate pests management plan and assessment of monitoring activities. The landowner must also complete the 'Diary template for vertebrate pest management' below to record the management actions undertaken, including any minor variations, and observations made.

### Vertebrate pests

Feral type	Name of vertebrate pest	Description of extent	Management zone/s	Method of control	Frequency & timing of control	Method of monitoring	Monitoring date/s
A	Foxes	Locally prevalent within site and adjacent National Park land – probably attracted by adjacent waste disposal site  Note: baiting will not be undertaken by biobank site owner, but by the National Parks and Wildlife Service in Garigal National Park.	All (MZ1-MZ5)	Baiting with 1080 baits buried 10cm into ground	Twice a year as a component of the regional fox control program undertaken by National Park and local Council	Record baits taken, opportunistic sitings	Twice a year as a part of regional fox control program undertaken by National Park and local Council
B	Feral Cat	Occasional throughout biobank site, all management zones, probably attracted by adjacent waste disposal site.	All (MZ1-MZ5)	Undertake cage trapping of feral cats when observed on the biobank site in conjunction with local council	Ongoing, as required	Record number /dates of feral cats trapped. Record observations of cats during routine site inspection. and spotlighting surveys	As required, ongoing

Methods considered		
Pest type	Name and description of program or method	Describe suitability
A	OEH/Warringah Council Fox Control Program (part of Fox TAP for Southern Brown bandicoots)	The effectiveness of any Fox control program on the biobank site will be enhanced by coordinating management activities with NPWS and/or Warringah Council
B	WSN/Warringah Council Cat Control Program at Belrose Waste Treatment facility	The effectiveness of any cat control program on the biobank site will be enhanced by coordinating management activities with WSN and/or Warringah Council

Template for reporting of monitoring activities			
Management zone/s	Date	Current level of impact on vegetation or threatened fauna species This column must record impact as Negligible, Minimal, Moderate or High	Observations and assessment of monitoring

Diary template for vertebrate pest management			
Date of activity	Management zone/s	Description and type of activity undertaken This column must include details of the vertebrate pests targeted, control techniques applied and numbers controlled.	Minor variations (details and reasons)


## Annexure D: Monitoring, reporting and record keeping requirements

*This Annexure D, together with Annexure C, is approved as a property management plan prepared by the landowner under the section 113B of the Threatened Species Conservation Act 1995.*

### 1 Monitoring requirements

- 1.1 The landowner must ensure that photographs are taken at photo-points at each of the locations and in the direction identified in the table below titled 'Locations of plots and photo points' within 12 months of the commencement date and then at least every 12 months thereafter.
- 1.2 The photo points are identified on the map entitled 'Plot Transect and Photo-Point Locations' dated 11/05/2010 and included in Annexure A of this agreement. The purpose of the photographs is to show changes over time. Photographs should be taken at approximately the same direction, location, height and time of day (during daylight hours) in each reporting period (as defined in paragraph 2.2 of this Annexure) and retained for the life of this agreement. All photographs must be dated, stating the direction in which they were taken and identified with their locations.

Locations of plots and photo points			
Projected coordinate system: GDA 94 AMG Zone 56			
Plot or photo point reference	Easting	Northing	Direction of photo
1	334357	6268531	Taken from each plot corner pointing towards the centre of plot.
2	334217	6268507	Taken from each plot corner pointing towards the centre of plot.
3	333962	6268469	Taken from each plot corner pointing towards the centre of plot.
4	334085	6268454	Taken from each plot corner pointing towards the centre of plot.
5	334400	6268378	Taken from each plot corner pointing towards the centre of plot.
6	334257	6268285	Taken from each plot corner pointing towards the centre of plot.
7	334239	6268261	Taken from each plot corner pointing towards the centre of plot.
8	334392	6268443	Taken from each plot corner pointing towards the centre of plot.
9	334183	6268438	Taken from each plot corner pointing

			towards the centre of plot.
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- 1.3 An inspection of the biobank site must be undertaken by, or on behalf of, the landowner in accordance with the table 'Site inspection and monitoring schedule' below, for the purposes specified in column A and at the relevant interval specified in column B. The inspections are to occur at the intervals indicated starting from the commencement date. The inspections are additional to any inspections and monitoring required by Annexure C.

Site inspection and monitoring schedule	
A. Purpose	B. Interval
The percentage of ground cover present on the biobank site for the purposes of paragraph 1.1 of Annexure C.	Every 12 months
Number of stock and date/s when stock have entered the management zones on the biobank site.	Every 3 months
Physical condition of fencing and gates to determine whether they are maintained to a standard that can control the movement of stock if required under items 1.2 and 1.3 of Section 1 of Annexure C.	Every 12 months
Records of any human disturbance on the biobank site. Note: items 4.1 and 4.2 of Section 1 of Annexure C and clause 2.6 of this agreement place restrictions on human activities on the biobank site.	Every 6 months
Evidence of erosion. Note: item 8 of Section 1 of Annexure C contains requirements for erosion control.	Every 6 months
Evidence of waste. Note: item 4.4 of Section 1 of Annexure C contains requirements for storing and disposing of waste on the biobank site.	Every 6 months
Physical condition of any fencing required to be installed by item 4.6 of Section 1 of Annexure C to deter waste dumping, to determine whether fencing is maintained to a standard that will deter waste dumping.	Every 12 months
Physical condition of signage required to be installed by item 4.6 of Section 1 of Annexure C to deter waste dumping, to determine whether the writing and images on the signs are clearly visible and legible and the signs are otherwise in good condition.	Every 12 months

## 2 Reporting requirements – annual report

- 2.1 The landowner must complete and submit to the Director General for approval an annual report using the annual reporting template provided in this Annexure or, if the Director General has approved an amended version of the annual reporting template after the commencement date, such an amended version of the annual reporting template as has been approved by the Director General from time to time and supplied to the landowner.
- 2.2 An annual report must be prepared for each reporting period. A 'reporting period' means:

2.2.1 prior to the date the balance in the biobank site account is equal to or greater than 80% of the Total Fund Deposit for the first time, the period of 12 months after the commencement date, and each subsequent period of 12 months

2.2.2 after the date the balance in the biobank site account is equal to or greater than 80% of the Total Fund Deposit for the first time, the period of 12 months after that date, and each subsequent period of 12 months.

The annual report submitted after the first anniversary of the date the balance in the biobank site account is equal to or greater than 80% of the Total Fund Deposit for the first time must also include the period between the last anniversary of commencement of this agreement and the date the balance in the biobank site account is equal to or greater than 80% of the Total Fund Deposit for the first time.

2.3 The annual report for the report period must be supplied to the Director General by registered post not later than 30 days after the end of each reporting period.

2.4 If there is a change in land ownership during a reporting period, each landowner must submit the annual report required under paragraphs 1.2, 1.3 and 1.4 of this Annexure for the period for which they were the landowner.

2.5 The annual report must:

2.5.1 contain the results of any monitoring, inspections or surveys required in Annexure C

2.5.2 contain the results of the inspections required to be conducted by paragraph 1.2 of this Annexure, including details of the date, time, location and nature of the inspection, the name of the person conducting the inspection and observations from the inspection

2.5.3 include the photographs taken at the photo points listed in Annexure D

2.5.4 include any other information required in the annual reporting template.

## Annual reporting template

### Biobank site annual report

#### Location details

Biobanking agreement ID:

Name of landowner/s:

Reporting date:

Property address:

#### Records of management actions undertaken

Management action	Required completion time and frequency	Action completed (Yes/No)	Actual completion date/s	Description of actions undertaken (including where undertaken, any variations and the reasons for variation)	Visual observations and other comments (including reasons for non completion)
1 Management of grazing for conservation					
2 Weed control					
3 Management of fire for conservation					
4 Management of human disturbance					
5 Retention of native vegetation					
6 Planting or seeding					
7 Retention of dead timber					
8 Erosion control					



<b>9 Retention of rocks</b>					
<b>10 Control of feral and overabundant native herbivores</b>					
<b>11 Vertebrate pest management</b>					
<b>12 Nutrient control</b>					
<b>13 Control of exotic fish species</b>					
<b>14 Maintenance or reintroduction of natural flow regimes</b>					

### Incident or event that has adverse effect on biodiversity values on biobank site

Incident or event including adverse impacts (e.g. natural events)	Action taken and proposed recommended actions

### Records submitted with this report

- ☐ Photographs taken at the photo points set in the biobanking agreement.
- ☐ Results of the inspections required to be conducted in clause 1.2 of Annexure D to the biobanking agreement.
- ☐ Results of any monitoring, inspections or surveys required in Annexures C and D to the biobanking agreement.

**Signature and certification**

I hereby declare that the information supplied in this report is accurate and complies with the reporting requirements under clause 2 of the Annexure D to the biobanking agreement.

Note: If the land that forms the biobank site is owned by multiple persons, each landowner must sign this annual report.

Signed

Signed

Date

Date

### 3 Record keeping requirements

- 3.1 The following written records and photographs must be created and retained by the landowner:
- 3.1.1 for a management action required by this agreement (other than a management action requiring the landowner to refrain from an activity), the date and location/s the management action was carried out and a description of the actions that were undertaken
  - 3.1.2 for a management action which is permitted to be carried out only in accordance with the Director General's consent or approval, a copy of that consent or approval
  - 3.1.3 a copy of any management plan (or updated management plan) required by Annexure C of this agreement that has been approved by the Director General, a copy of the Director General's approval of the management plan (or updated management plan) and a copy of any review of a management plan required by Annexure C
  - 3.1.4 the diaries for recording actions undertaken in accordance with the management plans required by this agreement including the details (management zone/s, date, alternative action) of any minor alterations made to the implementation of those management plans and the reasons for the minor alterations
  - 3.1.5 all photographs required by paragraph 1.1 of this Annexure and the information that clause requires to be recorded on the photographs
  - 3.1.6 for an inspection required by this agreement, the date, time, location and nature of the inspection, the name of the person conducting the inspection and observations from the inspection
  - 3.1.7 the results of monitoring, inspections or surveys required to be conducted by this agreement or any management plan that is required to be implemented under this agreement
  - 3.1.8 a brief description of any climatic, weather, ecological/environmental or unplanned events that have a significant adverse affect on the biodiversity values of the biobank site.
- 3.2 The landowner must retain a copy of each annual report.
- 3.3 All records required to be kept by this agreement must be:
- 3.3.1 in a legible form, or in a form that can readily be reduced to a legible form (this includes photographs taken as part of this agreement)
  - 3.3.2 kept for at least 10 years after the event to which they relate took place, unless specified otherwise
- Note: paragraph 1.1 of this Annexure requires the photographs required to be taken under that clause to be retained for the life of this agreement.
- 3.3.3 produced to any authorised officer on request by an authorised officer.

## **Annexure E: Payment schedules**

### **Note:**

If, by participating in the BioBanking Scheme, you are carrying on an 'enterprise', and your annual income for management actions meets or exceeds \$75,000 (or \$150,000 for a non-profit organisation) you are required to register for GST.

'Enterprise' has a broad definition, and includes activities that are in the form of a business, or in the form of a concern in the nature of trade. Section 1 below assumes you are carrying on an enterprise.

If you are not carrying on an enterprise by participating in the BioBanking Scheme, GST will not apply to you – but Capital Gains Tax and income tax may still apply. In this case do not indicate an ABN in item 4 below.

If you do not meet the monetary threshold, but you are carrying on an enterprise by participating in the BioBanking Scheme, you are still entitled to register for GST if you wish and you may indicate a registered ABN in section 4 below.

### **1 Agreement to issue recipient created tax invoices**

- 1.1 The parties acknowledge that, if the landowner is registered for GST, recipient created tax invoices will be issued from the BioBanking Trust Fund (Australian Business Number 83 639 386 285) to the landowner (Australian Business Number ABN 56 784 733 957).
- 1.2 The recipient created tax invoices will be for the supply by the landowner of the landowner's obligation to carry out the management actions as defined in this biobanking agreement ('the supplies'). These management actions are specified between the landowner and the Minister administering the Act, pursuant to Part 7A Division 2 of the Act.
- 1.3 The recipient created tax invoices will be issued on payment of the annual payments as specified in item 2 of this Annexure.
- 1.4 Under this recipient created tax invoice agreement, the landowner guarantees that the landowner will not issue any tax invoice for the supplies.
- 1.5 The landowner will notify the BioBanking Trust Fund immediately should the landowner cease to be registered for GST.
- 1.6 The BioBanking Trust Fund is registered for GST and the Minister will notify the landowner immediately should the fund cease to be registered.

### **2 Payment timing and amount**

- 2.1 Subject to clause 12 of the agreement, the Minister is to direct the trust fund manager to make the management payments to the landowner in accordance with the payment schedules.
- 2.2 The first year of the payment timing, as set out in the payment schedules, commences from the first payment date.

- 2.3 The amount of the scheduled management payment for each year is as set out in the payment schedules.
- 2.4 Each amount is listed in the present value and is inclusive of GST for GST registered landowners and will be adjusted for the inflation index annually.
- 2.5 Payment Schedules

Payment schedule	
Payment timing	Amount
At the beginning of the first year	\$82,830
At the beginning of the second year	\$42,130
At the beginning of the third year	\$42,130
At the beginning of the fourth year	\$36,080
At the beginning of the fifth year	\$30,358
At the beginning of the sixth year	\$26,180
At the beginning of the seventh year	\$11,440
At the beginning of the eighth year	\$11,440
At the beginning of the ninth year	\$11,440
At the beginning of the tenth year	\$16,940
At the beginning of the eleventh year	\$12,540
At the beginning of the twelfth year	\$11,440
At the beginning of the thirteenth year	\$11,440
At the beginning of the fourteenth year	\$11,440
At the beginning of the fifteenth year	\$16,940
At the beginning of the sixteenth year	\$12,540
At the beginning of the seventeenth year	\$11,440
At the beginning of the eighteenth year	\$11,440
At the beginning of the nineteenth year	\$22,440
At the beginning of the twentieth year	\$16,940
At the beginning of each following year	Amount equal to the sum of the in perpetuity management cost that apply for each following year as determined by the table of in perpetuity costs below.

In perpetuity management costs (on and from the twenty-first year)		
Ongoing management action	Payment timing	Amount (\$)
Fence maintenance	Every year	\$1800
Implementation of ecological burns	The thirty-fourth year and every fifteenth year thereafter	\$10,000

Weed control	Every year	\$3,100
Control of feral herbivores (rabbits)	Every year	\$1,500
Management of human disturbance	The twenty-first year and every fifth year thereafter	\$1,000
<b>Other ongoing recurring costs</b>		
Annual reporting fee	Every year	\$1,122
Insurance premiums	Every year	\$500
Periodic review of the management plans	The twenty fifth year and every fifth year thereafter	\$5,000
Preparation of annual report	Every year	\$2,500
Monitoring of photo points	Every year	\$1,000

### 3 Nominated bank account

- 3.1 The management payments will be paid into a bank account as nominated by the landowner in accordance with the requirements of this item 3 (**'the Nominated Bank Account'**).
- 3.2 The landowner must provide the Fund Manager with details in writing of the nominated bank account within 14 days of the commencement date.
- 3.3 Where there is more than one owner of the biobank site, the notice to be provided in accordance with item 3.2 above must be signed by all owners of the biobank site.
- 3.4 The landowner must notify the Fund Manager in writing within 14 days of any change to the nominated bank account. This notice must include new bank account information and the written consent of all owners of the biobank site.

### 4 Annual contribution

- 4.1 The landowner authorises the Minister to retain the annual contribution from each management payment made to the landowner.
- 4.2 The Minister will, following each management payment, issue the landowner with an invoice confirming that the annual contribution has been deducted from the relevant management payment.
- 4.3 As contemplated by clause 18 of the BioBanking Regulation, the Minister may waive the annual contribution where:
  - 4.3.1 the owner of the biobank site has not sold any of the biodiversity credits created for the site, or
  - 4.3.2 there are insufficient funds in the biobank site account relating to the biobank site to meet the next scheduled management payment when it becomes payable.

# Appendix C

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Biobanking Assessment for Northern Beaches Hospital Site

# **Northern Beaches Hospital Precinct Development BioBanking Assessment Report**



**Prepared for SMEC Australia and Health Infrastructure**

**Teresa James July 2013**



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Figure 2 – Vegetation mapping and development footprints

Figure 3 - Map showing 100 ha and 1000 ha assessment circles

### APPENDICES

Appendix 1 – Figures 1-3

Appendix 2– Plot and transect data summary

Appendix 3 – Biobanking Credit Report x 4

## 1. INTRODUCTION

### 1.1 Background

A proposed new hospital at French's Forest, referred to as the Northern Beaches Hospital Precinct, is a State Significant Development (SSD) in accordance with Clause 14 of Schedule 1 of the State Environmental Planning Policy (State and Regional Development) 2012. A draft Biodiversity Specialist Report has been prepared by SMEC (2012) to consider the potential environmental impact of the project, in keeping with the legislative requirements of Part 4 of the *Environmental Planning and Assessment Act* 1979 (EP&A Act). These studies have identified the presence of a threatened ecological community and one threatened fauna species at the site. The proposed development will result in the clearing of up to approximately 5 ha of remnant vegetation comprising the Duffys Forest Endangered Ecological Community which is listed under the Threatened Species Conservation Act (TSC Act 1995). The site is also located within a Priority 1 Vegetation Corridor (Smith and Smith 2005). To reliably determine the biodiversity values and offsetting requirements of vegetation affected by the proposed development the Biobanking Assessment Methodology (BBAM) has been used to calculate ecosystem and species credits. This approach is consistent with the NSW OEH interim policy on assessing and offsetting biodiversity impacts of State significant development (SSD) and State significant Infrastructure (SSI) projects (OEH 2011).

### 1.2 Hospital site

The hospital site is located at French's Forest, approximately 15 km north of the Sydney CBD on either side of Bantry Bay Rd and bounded by the Wakehurst Parkway, Warringah Road and French's Forest Road West. The land is owned entirely by Health Infrastructure (HI). The subject site includes the following lots:

Lots 12, 13, 14, 15 DP 792918

Lot 1 DP 1179362 comprising of Lot 1 DP 119383; Lot 11 DP792918 and part of Bantry Bay Road

Lots 2, 3, 4, 5, 6, 7, 8, 9, 10 DP 26087

The majority of the site is vegetated but includes former house blocks along Bantry Bay Road. A brief summary of key environmental characteristics of the site and surrounds is provided:

- The site is located on higher land (150-160 m above sea level) comprising a plateau surface and gentle slopes. Steeper slopes and sandstone gullies occur to the north and south of the site associated with creek systems including Curl Curl Creek, Carroll Creek and Middle Creek.
- The soil profile observed along Frenchs Forest Road West indicates a relatively deep clay-loam soil above sandstone with outcropping restricted to a small area in the vicinity of the Wakehurst Parkway and French's Forest Road West intersection. Small iron and sandstone fragments occur over the soil surface in parts of the site but are rarely concentrated.
- Native vegetation comprises a mosaic of open-woodland to open-forest with a well-developed shrub layer. Regenerating and disturbed areas have a strong sedge and grass component.
- Disturbance is evident reflecting a history of clearing, fire, access (including several tracks) and residential development along Bantry Bay Road.

- Weed invasion is evident along the perimeter of the site, along tracks and in the vicinity of previous dwellings.

A map of the hospital site and a larger hospital precinct is shown in Figure 1 of Appendix 1.

### 1.3 Vegetation

Two vegetation communities have been previously identified at the site. Warringah Council mapping, based on Smith and Smith (2000), identifies Duffy's Forest EEC at the site and on adjoining lands particularly to the east of the Wakeshurst Parkway (formerly Blinking Light Reserve) and to the south of Warringah Road on either side of the Parkway and along Aquatic Drive. Draft mapping for the Sydney Metropolitan Catchment Management Area (DEECW 2009), however, maps the site as Coastal Shale Sandstone Forest (CSSF). CSSF is a newly described community of undetermined conservation status although it has strong affinities with the Shale Sandstone Transition Forest EEC listed under both state and national legislation. The results from site surveys undertaken by SMEC (2012), including peer review (James 2013) support the presence of Duffy's Forest as defined under the TSC Act (1995).

#### Duffy's Forest

A mosaic of open-woodland to open-forest is found across the site with a good tree canopy and shrubby understory with sedges and grasses also well represented in the ground layer. The dominant canopy species is *Angophora costata* with *Eucalyptus umbra*, *E. sieberi* and *Corymbia gummifera* occurring at lower frequencies. Red Mahogany (*Eucalyptus resinifera*) and White Stringybark (*E. globoidea*) are locally common in southern parts of the site. The condition is variable with zones of more intact vegetation, areas regenerating after fire and a narrow zone around the perimeter of the site and to the east of former residential lots that is weed affected. Approximately 140 native flora species are recorded from the hospital site. More detailed information is provided in SMEC (2012).

### 1.4 Proposed development

The main hospital development will result in clearing of most of the site for buildings and car parking. To allow adequate access for construction, services currently located along Bantry Bay Road will need to be moved prior to works commencing. The new locations proposed for pipeline easements are within the hospital site but the overhead transmission lines are proposed to be re-located just within the road reserve east of the site boundary. Four development scenarios are assessed in this report as summarized below:

1. Clearing for hospital, car parking and pipeline diversions (entire site).
2. Re-location of services underground requiring trenching along northern, western and southern boundaries of hospital site west of Bantry Bay Road – Pipeline Option 1
3. Re-location of services underground as above – Pipeline Option 2 with a different location along the northern boundary (further into the site).
4. Re-location of overhead transmission lines in the road reserve located on the eastern boundary of the hospital site adjacent to the Wakehurst Parkway.

The service diversion development footprints are shown in figure 2. The hospital site footprint is based on the site as shown in figure 1 (Appendix 2). The proposed easements are 2.6 m wide except along the western boundary where it is 5.6 m wide.

## 2. BIOBANKING ASSESSMENT METHODOLOGY (BBAM)

### 2.1 Background Information

The assessment is based primarily on existing information (SMEC 2012) including mapping, database records and survey data (in part). Vegetation mapping by Warringah Council and OEH (draft SMCMA 2009) has been reviewed. A review was undertaken to confirm the presence of Duffy's Forest endangered ecological community at the site (James 2013a). Additional plot/transect survey was undertaken in May 2013. GIS mapping was provided by SMEC (see Appendix 1) and included:

- The site boundary (figure 1);
- Mapping of vegetation including condition across the site (figure 2);
- Assessment circles of 100 ha and 1,000 ha surrounding the subject site to determine native vegetation cover and condition (Figure 3).
- Development footprints (figures 1 & 2).

### 2.2 Preliminary assessment

Three vegetation zones were provisionally identified based on existing information each representing a general condition state for the one vegetation type present (Duffy's Forest equivalent) and each zone being >0.25 ha in size. Based on the size of these zones the number of plots/transects required was determined (1 per zone); additional plots were identified to more fully sample areas affected by the diversion of services. Survey and assessment for threatened species had been addressed previously (SMEC 2012).

### 2.3 Field survey

Flora studies were undertaken at the site by SMEC in June and October, 2012. Fauna surveys were also undertaken in June and October, 2012 and late summer 2013, targeting threatened species within the proposed site.

Table 1: Summary of flora survey

Report	Dates	Study area	Survey details
SMEC (2012)	June 2012	Hospital site	Three plots/transects (50m) were sampled in the main vegetation zones.
SMEC (2012)	October 2012	Hospital site	Nine plots/transects (50m) surveyed with full floristic data recorded in 20 m x 20 m plots to assist in community identification.
James (2013a)	27 December	Hospital site & adjoining areas	Field check of vegetation communities and condition (3 hours).
James (2013b) BioBanking Report	8 & 9 May	Hospital site & part of Brick Pit Reserve south of Warringah Road	Provisional vegetation zones checked; two additional plots/transects (50m) were sampled.

Table 2: Summary of fauna survey

Report	Dates	Study Area	Survey details
SMEC (2012)	June 2012	Hospital site	Stratified sampling using arboreal traps, cage traps and pitfall traps
SMEC (2012)	October 2012	Hospital site	Stratified sampling using arboreal traps, cage traps and pitfall traps
SMEC (2013)	March 2013	Hospital site	Stratified sampling using arboreal traps, cage traps and pitfall traps

The systematic flora and fauna surveys and habitat assessments were undertaken in accordance with OEH recommendations (DEC, 2004) and discussions with the department. The winter 2012 flora surveys were undertaken according to methodology outlined in the Vegetation Type Standard (DECCW 2009). Following subsequent discussions with OEH the spring flora surveys were undertaken according to a combination of BBAM (50m transects for site value data) and Vegetation Type Standard methodology (full floristic in 20m x 20m plots). A summary of survey details is provided in tables 1 and 2.

## 2.4 Verification of vegetation types and vegetation zones

Duffy's Forest EEC is present across the site and is equivalent to the vegetation type Red Bloodwood – Smooth-barked Apple shrubby forest on shale or ironstone (ME039).

Although all vegetation at the site meets the biobanking condition criteria for “good to moderate” differences in condition, degree of disturbance and canopy dominants occur. Based on field checking four vegetation zones were identified as summarized in table 4. There is a small patch of “low” condition in the far north-west corner but it is less than 0.25 ha in size and included in the adjoining zone 3 (moderate/good – poor).

### Landscape value

The landscape values required for the assessment were derived from GIS mapping of the site and surrounding lands using 100 ha and 1,000 ha circles and are summarized in table 3.

Table 3: Landscape value

CMA	CMA sub-region	Minimum surrounding vegetation cover	Minimum patch size
Sydney Metro	Pittwater (Part B)	31-70%	>100 ha

## 2.5 Identification of threatened species for assessment

All threatened flora and fauna species assessment and survey has been undertaken previously by SMEC with no additional work undertaken.

## 2.6 Assumptions

The following assumptions have been made for the site in calculating ecosystem and species credit for the credit reports and development assessment.

- The entire hospital site (as shown in figure 1) will be cleared of vegetation.

- The overhead transmission line easement will retain a modified understory.
- There is likely to be additional direct and indirect impacts on good condition vegetation associated with the re-location of the overhead transmission line in the road reserve adjacent to the Wakehurst Parkway. Some vegetation is likely to be cleared and some trees lopped to facilitate vehicular access.
- All threatened species survey and assessment data used in the credit calculation has been undertaken in accordance with threatened species survey guidelines provided in the Operational Manual or by DECCW.

### 3. VEGETATION

#### 3.1 Vegetation Types

One vegetation type is present at the site Red Bloodwood – Smooth-barked Apple shrubby forest on shale or ironstone (ME039) and is equivalent to the Duffy's Forest EEC. There is a deep clay soil profile across the site except in the far north-east corner (outside of the hospital site) where some sandstone outcrop is evident. Reflecting the strong clay influence, limited concentration of ironstone gravels and past disturbance the understory is more of a shrubby/grassy form than the shrubby understory of this vegetation type as identified in the Vegetation Types database. Accordingly the benchmarks for understory values are generally exceeded. Although the use of local benchmark data is an option it is not considered warranted in this case as a formal Biobanking Statement is not required. A summary of plot/transect data used is provided in Appendix 2.

#### 3.2 Vegetation Zones

Four vegetation zones are identified as shown in table 4 and summarized below.

##### *Zone 1- Moderate/Good – High*

Least disturbed vegetation with a well-developed canopy cover and understory. Dominant or characteristic native species within this zone are identified below:

**Trees** - *Angophora costata*, *Eucalyptus umbra*, *Allocasuarina littoralis*, *Corymbia gummifera*,

**Shrubs** – *Acacia linifolia*, *Leptospermum trinervium*, *Pultenaea hispidula*, *Bossiaea obcordata*, *Lasiopetalum ferrugineum*, *Prostanthera denticulata*

**Ground layer (grasses)** – *Entolasia stricta*, *Microlaena stipoides*

**Ground layer (other)** – *Lomandra obliqua*, *Lomandra longifolia*, *Dianella caerulea*, *Pteridium esculentum*, *Caustis flexuosa*, *Gahnia radula*

##### *Zone 2- Moderate/Good – Other*

Central part of site regenerating after fire several years previous. More open canopy and dense shrub/sedge layers. Dominant or characteristic native species within this zone are identified below:

**Trees** - *Angophora costata*, *Eucalyptus umbra*, *Allocasuarina littoralis*, *Corymbia gummifera*

**Shrubs** – *Acacia floribunda*, *Acacia linifolia*, *Pultenaea tuberculata*, *Kunzea ambigua*, *Leptospermum trinervium*, *Dodonaea triquetra*, *Pittosporum undulatum*

**Ground layer (grasses)** – *Entolasia stricta*, *Austrostipa pubescens*

**Ground layer (other)** – *Lomandra obliqua*, *Lomandra longifolia*, *Dianella caerulea*, *Pteridium esculentum*, *Caustis flexuosa*, *Gahnia radula*, *Lepidosperma laterale*, *Xanthosia tridentata*

Table 4: Vegetation zones (all within Red Bloodwood – Smooth-barked Apple shrubby forest on shale or ironstone (ME039))

Vegetation Zone	Size (ha)	Condition	Number of plots/transects used	Duffy's Forest EEC
1	1.58	Moderate/Good – High	3	Yes
2	1.50	Moderate/Good – Other (regenerating)	1	Yes
3	1.15	Moderate/Good – Poor (edge effects /disturbed)	2	Yes
4	0.68	Moderate/Good – Medium	1	Yes

#### Zone 3- Moderate/Good – Poor

Peripheral areas of the site exposed to ongoing edge effects, pedestrian traffic and localized clearing. Canopy cover is good and the condition of the understory variable ranging from predominantly native to exotic dominated. This zone includes a small area near the entrance in the north-west corner of the site that is “low condition” but is too small (<0.25 ha) to be assessed as a separate zone. There appears to have been some recent weed control in parts of this zone. A larger area mapped as zone 3 east of Bantry Bay Road has a good mature tree cover with a higher number of hollows than elsewhere at the site but a predominantly exotic grass understory. Dominant or characteristic native species within this zone are identified below:

**Trees** - *Angophora costata*, *Eucalyptus umbra*, *Eucalyptus resinifera*, *Allocasuarina littoralis*

**Shrubs** – *Acacia floribunda*, *Leptospermum trinervium*, *Ozothamnus diosmifolius*, *Dodonaea triquetra*, *Pittosporum undulatum*, *Grevillea linearifolia*

**Ground layer (grasses)** – *Entolasia stricta*, *Imperata cylindrica*

**Ground layer (other)** – *Lomandra longifolia*, *Dianella caerulea*, *Pteridium esculentum*

#### Zone 4- Moderate/Good – Medium

In southern parts of the site on a gentle south-facing slope there is a stronger shale influence and more mesic conditions. A taller canopy dominated by Smooth-barked apple (*Angophora costata*), Red Mahogany (*Eucalyptus resinifera*) and White Stringybark (*Eucalyptus globoidea*) occurs in this area and is consistent with the White Stringybark – Red Mahogany form of Duffy's Forest of Smith & Smith (2000). Dominant or characteristic native species within this zone are identified below:

**Trees** - *Angophora costata*, *Eucalyptus resinifera*, *Eucalyptus globoidea*

**Shrubs** – *Ozothamnus diosmifolius*, *Dodonaea triquetra*, *Pittosporum undulatum*, *Acacia longissima*, *Kunzea ambigua*

**Ground layer (grasses)** – *Entolasia stricta*, *Entolasia marginata*, *Imperata cylindrica*, *Microlaena stipoides*

**Ground layer (other)** – *Lomandra longifolia*, *Dianella caerulea*, *Pteridium esculentum*, *Hypolepis muelleri*, *Gahnia radula*, *Pratia purpurascens*

## 4. RESULTS – CREDIT REQUIREMENTS

The data from the field surveys and mapping was entered into the calculator (Version 2) to determine the number of credits required to offset the impacts of the four development scenarios described in section 1.4.

### 4.1 Ecosystem Credits

All vegetation affected is identified as a Red Flag because of its EEC status and under the BBAM cannot be cleared unless an application for a red flag determination is approved. Refer to Appendix 3 for the Biobanking Credit Reports (BBCR). A summary of the results is provided in tables 5-8.

Table 5: Ecosystem credits summary – Northern Beaches Hospital Precinct (entire site)

Vegetation zone	Area (ha) developed	Surrounding vegetation cover class in which the vegetation must be obtained	Minimum area of contiguous vegetation in which credits must be obtained	Red flag	Ecosystem credits required
1 High	1.58	>30%	>100 ha	Yes	118
2 Other	1.50	>30%	>100 ha	Yes	87
3 Poor	1.15	>30%	>100 ha	Yes	74
4 Medium	0.68	>30%	>100 ha	Yes	44
<b>Total</b>	<b>4.91</b>				<b>323</b>

Table 6: Ecosystem credits summary – Pipeline re-location Option 1 (Northern Beaches Hospital 1)

Vegetation zone	Area (ha) developed	Surrounding vegetation cover class in which the vegetation must be obtained	Minimum area of contiguous vegetation in which credits must be obtained	Red flag	Ecosystem credits required
1 High	0.06	>30%	>100 ha	Yes	3
3 Poor	0.15	>30%	>100 ha	Yes	8
4 Medium	0.12	>30%	>100 ha	Yes	7
<b>Total</b>	<b>0.33</b>				<b>18</b>



Table 7: Ecosystem credits summary – Pipeline re-location Option 2 (Northern Beaches Hospital 2)

Vegetation zone	Area (ha) developed	Surrounding vegetation cover class in which the vegetation must be obtained	Minimum area of contiguous vegetation in which credits must be obtained	Red flag	Ecosystem credits required
1 High	0.09	>30%	>100 ha	Yes	4
3 Poor	0.23	>30%	>100 ha	Yes	12
4 Medium	0.19	>30%	>100 ha	Yes	11
<b>Total</b>	<b>0.51</b>				<b>27</b>

Table 8: Ecosystem credits summary – re-location of overhead transmission line (Northern Beaches Hospital 3)

Vegetation zone	Area (ha) developed	Surrounding vegetation cover class in which the vegetation must be obtained	Minimum area of contiguous vegetation in which credits must be obtained	Red flag	Ecosystem credits required
1 High	0.20	>30%	>100 ha	Yes	5
<b>Total</b>	<b>0.20</b>				<b>5</b>

## 4.2 Species Credits

No threatened flora species were recorded in the surveys undertaken and no records are previously known from the site although a large number have been recorded from within a 10 km radius (SMEC 2012). The most likely to occur is Caley's Grevillea (*Grevillea caleyi*) for which targeted survey was undertaken (SMEC 2012).

One threatened fauna species, the Powerful Owl (*Ninox strenua*), was recorded from the site during surveys. The site contains suitable roosting trees close to a known nest site (within the adjacent school grounds) and foraging habitat (SMEC 2012). Details of the species credits required for offsetting impacts under the main hospital development and the individual service easement scenarios are shown in table 9.

Table 9: Species credits required to offset impacts on the Powerful Owl (*Ninox strenua*)

Development proposal	Extent of impact (ha)	Number of species credits required
Main hospital site development	4	121
Pipeline re-location Option 1	0.33	10
Pipeline re-location Option 2	0.51	15
Transmission Line re-location	0.20	6

The SMEC report (2012) notes that potential foraging habitat is present for other threatened fauna species although no additional species have been recorded in three surveys 2012-13.

### 4.3 Conversion of credits to hectares

The quantity of ecosystem or species credits can be converted into hectares of land to assist in the search for suitable offset sites (OEH Credit Converter). A summary of hectares required for the main hospital development is provided in table 10.

Table 10: Credit conversion

Credit Type	No. of credits required	Area of habitat required (hectares)
Ecosystem credits (Duffy's Forest ME 039)	323	35
Species credits – Powerful Owl ( <i>Ninox strenua</i> )	121	19

## 5. CONCLUSIONS

Native vegetation at the site is consistent with the Duffy's Forest EEC and accordingly is a "red flag" area under the BBAM. The ecosystem credits calculated for offsetting impacts on Duffy's Forest as a result of the main hospital development total 323 which converts to an offset area of 35 ha. Similarly, species credits for the Powerful Owl total 121 converting to an offset area of 19 ha.

Ecosystem credits calculated for the individual service re-location scenarios range from 6 (overhead transmission line) to 18 (pipeline Option 1) and 27 (pipeline Option 2). The species credits for the Powerful Owl are 6, 10 and 15 for the above scenarios respectively. The pipeline diversions occur within the hospital site and are included in the credit calculation for the main hospital development. The re-location of the overhead transmission line, however, is just within the road reserve and the credit requirements for this scenario are additional.

Under the BBAM approval for clearing of Red Flag areas requires development to "improve or maintain" biodiversity values through appropriate offsetting and retirement of the above credits. Special circumstances exist, however, for State Significant Projects whereby the "improve or maintain" standard does not have to be met. The NSW OEH interim policy on assessing and offsetting biodiversity impacts of State significant development (SSD) and State significant Infrastructure (SSI) projects (OEH June 2011) provides a three tier approach with no net loss and mitigated net loss outcomes possible. It is likely that the proposed hospital development will require assessment under Tier 3 as protection of red flag areas is not an option at the site and there are difficulties with offsetting the required credits. Duffy's Forest is a highly restricted ecological community with limited opportunities for biobank sites and retiring credits. The credit calculator identifies *Scribbly Gum – Red Bloodwood heathy woodland on the coastal plains of the Central Coast, Sydney Basin* (HU610) as an alternative offset option.

## 6. REFERENCES

DECC (2009). *Field data sheets for BioBanking: biobank / development site proposal package*. Department of Environment and Climate Change NSW, Hurstville

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DECCW (2010) Draft BioBanking Assessment Methodology (version 2).

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Gibbons et al (2008). *A Terrestrial Biodiversity Assessment Tool for the NSW Native Vegetation Assessment Tool (formerly Property Vegetation Plan Developer) Operational Manual*. NSW Department of Environment and Climate Change c/ CSIRO Sustainable Ecosystems

James, T.A (Jan 2013a) Northern Beaches Hospital Project - Vegetation Peer Review

NSW Scientific Committee (2011). Final Determination for the Duffys Forest ecological community as an endangered ecological community .NSW Scientific Committee, Hurstville

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OEH (2012) Assessors Guide to using the BioBanking Credit Calculator (version 2).

SMEC Australia (2012) Northern Beaches Hospital Project – Biodiversity Specialist Report

Smith, P. and Smith, J. (2000). Survey of the Duffys Forest Vegetation Community - Report to NSW National Parks and Wildlife Service and Warringah Council. P. & J. Smith Ecological Consultants, Blaxland

Smith, P. and Smith J. (2005) *Warringah Natural History Area Survey. Vegetation History and Wildlife Corridor* Unpublished report prepared for Warringah Council.





**Figure 2: Vegetation mapping and development footprints**

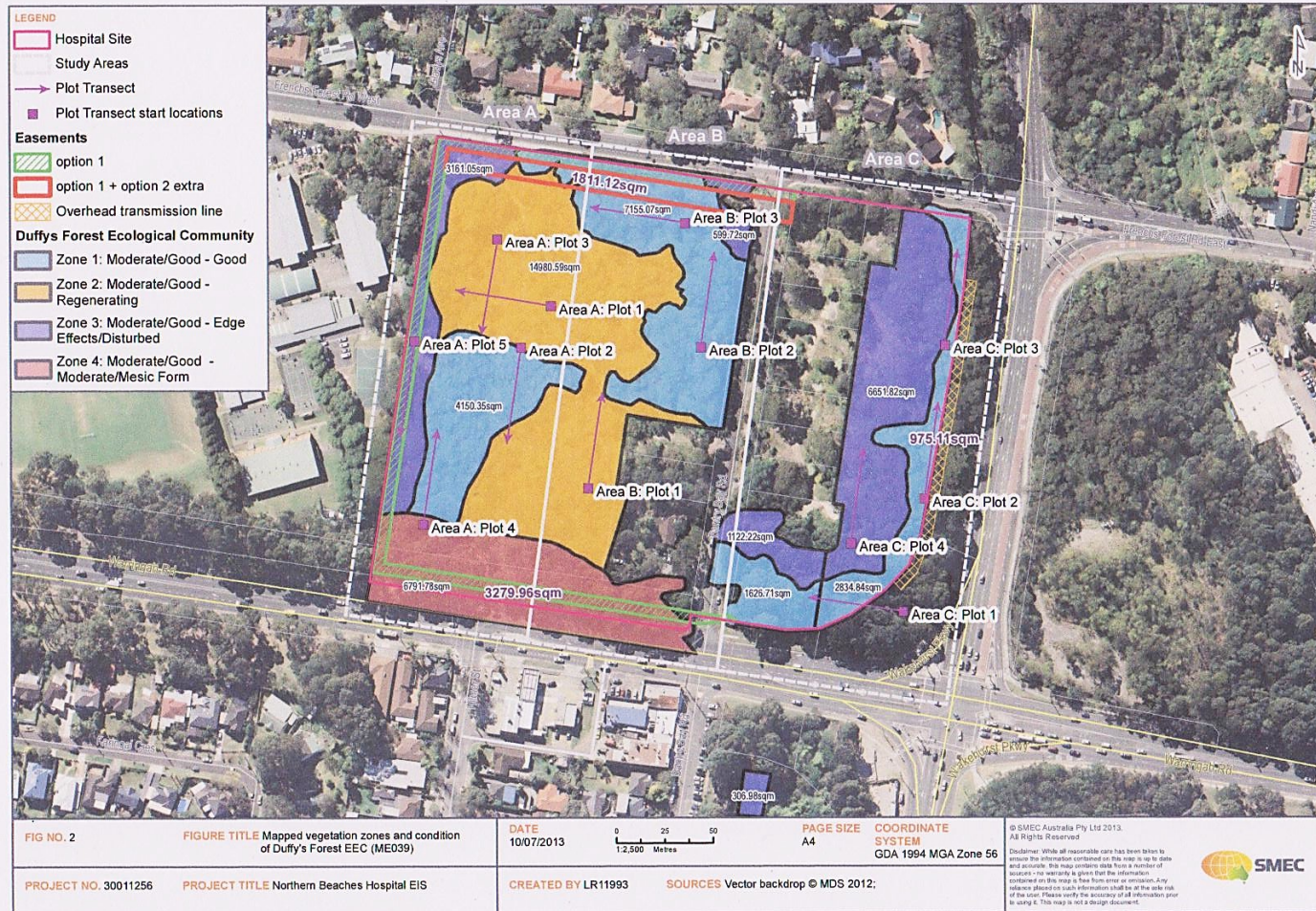
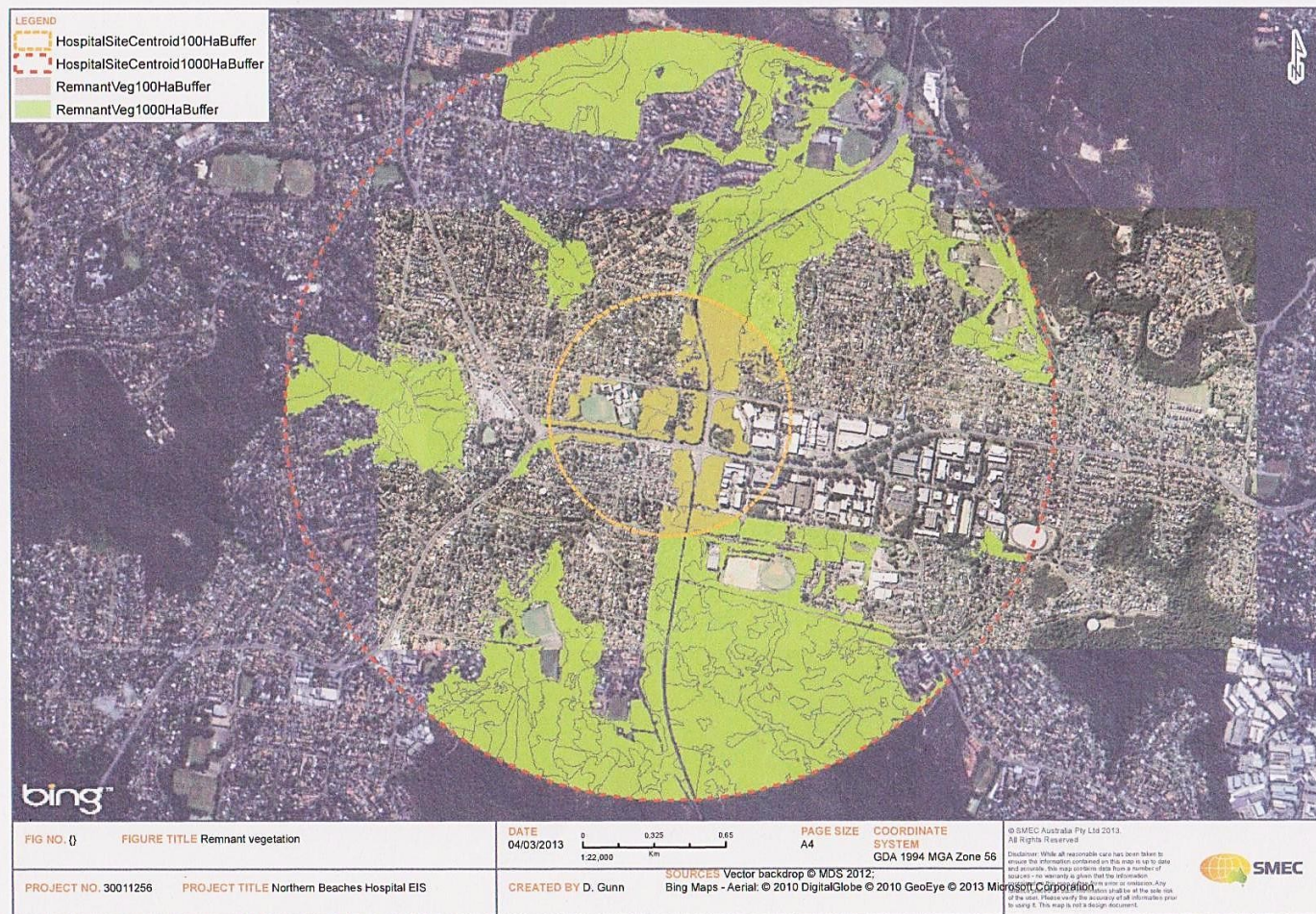




Figure 3: Map showing 100 h and 1000 ha assessment circles



**APPENDIX 2: Summary of transect/plot data used in biobanking assessment – Duffy’s Forest EEC (ME039 Red Bloodwood – Smooth-barked Apple shrubby forest on shale or ironstone)**

<b>Veg zone</b>	<b>Condition</b>	<b>Zone descriptor</b>	<b>Plot</b>	<b>Native species</b>	<b>Native overstorey % cover</b>	<b>Native midstorey % cover</b>	<b>Native grass % cover</b>	<b>Native subshrub % cover</b>	<b>Native other ground % cover</b>	<b>Exotic % cover</b>	<b>No. of tree hollows</b>	<b>Over-storey regeneration</b>	<b>Length fallen logs (m)</b>
01	Moderate/Good	High	TJ1	49	39	34	56	28	86	0	0	1	29
01	Moderate/Good	High	B2	39	39	9	54	10	36	0	3	1	27
01	Moderate/Good	High	C2	41	29	12	56	2	42	9	3	1	23
02	Moderate/Good	Other - regenerating	A3	22	3	17	42	4	54	0	2	1	0
03	Moderate/Good	Poor - edge-effects & disturbed	A5	24	24	13	22	0	6	56	0	0.5	0
03	Moderate/Good	Poor - edge-effects & disturbed	C4	32	38	1	4	0	8	91	3	0.5	0
04	Moderate/Good	Medium	TJ2	23	34	17	28	14	54	22	0	0.75	111

\*Number of native species based on species recorded in 20m x 20m floristic plots

**Table 2a. Floristic Plots (20 x20m) Location – MGA Zone 56**

<b>Plot ID</b>	<b>Easting</b>	<b>Northing</b>
TJ1	336303	6264182
B2	336346	6264096
C2	336461	6264018
A3	336241	6264152
A5	336198	6264099
C4	336423	6263995
TJ2	336198	6263800



# BioBanking Credit Calculator



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## BioBanking credit report

This report identifies the number and type of credits required at a DEVELOPMENT SITE.

Date of report: 10/07/2013

Time: 6:07:26PM

Tool version: 2.0

### Development details

**Proposal ID:** 0017/2013/0720D

**Proposal name:** Northern Beaches Hospital 3

**Proposal address:** Area bounded by Warringah Road, Bantry Bay Road, Frenchs Forest West Road & Wakeshurst Parkway Frenchs Forest NSW

**Proponent name:** Health infrastructure

**Proponent address:** Level 8, 77 Pacific Highway North Sydney NSW

**Proponent phone:** (02) 9978 5402

**Assessor name:** Teresa James

**Assessor address:** 835 Caparra Road CAPARRA NSW 2429

**Assessor phone:** 6550 7311

**Assessor accreditation:** 0017

### Improving or maintaining biodiversity

An application for a red flag determination is required for the following red flag areas

Red flag	Reason
Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin	Vegetation type being > 70% cleared; or it contains an endangered ecological community;

The application for a red flag determination should address the criteria set out in the BioBanking Assessment Methodology. Please note that a biobanking statement cannot be issued unless the determination is approved.

#### Additional information required for approval:

- ☐ Change to percent cleared for a vegetation type/s
- ☐ Use of local benchmark
- ☐ Change negligible loss
- ☐ Expert report
- ☐ Predicted threatened species not on site
- ☐ Change threatened species response to gain (Tg value)

## Ecosystem credits summary

Vegetation type	Area (ha)	Credits required	Red flag
Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin	0.20	5	Yes
<b>Total</b>	0.20	5	

## Credit profiles

### 1. Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin, (ME039)

Number of ecosystem credits required	5
CMA sub-region	Pittwater (Part B)
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
<p>Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin, (ME039)</p> <p>Scribbly Gum - Red Bloodwood heathy woodland on the coastal plains of the Central Coast, Sydney Basin, (HU610)</p>	<p>Pittwater (Part B)</p> <p>Clarence Lowlands</p> <p>Richmond - Tweed (Qld - Scenic Rim) (Part A)</p> <p>Murwillumbah (Qld - Southeast Hills and Ranges)</p> <p>Wollemi - Hawkesbury/Nepean</p> <p>Wollemi (Part A)</p> <p>Wollemi (Part B)</p> <p>Yengo - Hunter/Central Rivers</p> <p>Wyang</p> <p>Walcha Plateau - Northern Rivers</p> <p>Macleay Hastings - Hunter/Central Rivers</p> <p>Macleay Hastings - Northern Rivers</p> <p>Coffs Coast &amp; Escarpment</p> <p>Clarence Sandstones</p> <p>Jervis</p> <p>Bungonia - Hawkesbury/Nepean</p> <p>Sydney Cataract - Sydney Metro</p> <p>Pittwater</p> <p>Bateman</p>

Illawarra

South East Coastal Ranges (Part C)

Ellerston

Upper Hunter

Kerrabee - Hunter/Central Rivers

Wollemi (Part C)

Stanthorpe Plateau

Species credits

Common name	Scientific name	Extent of impact	Number of species credits required
Powerful Owl	Ninox strenua	0.20	6

# BioBanking Credit Calculator



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## BioBanking credit report

This report identifies the number and type of credits required at a DEVELOPMENT SITE.

Date of report: 10/07/2013

Time: 10:03:48AM

Tool version: 2.0

### Development details

**Proposal ID:** 0017/2013/0686D

**Proposal name:** Northern Beaches Hospital

**Proposal address:** Area bounded by Warringah Road, Wakeshurst Parkway, Frenchs Forest Road West  
Frenchs Forest

**Proponent name:** Health Infrastructure

**Proponent address:** Level 8, 77 Pacific Highway North Sydney

**Proponent phone:** 02 9978 5402

**Assessor name:** Teresa James

**Assessor address:** 835 Caparra Road CAPARRA NSW 2429

**Assessor phone:** 6550 7311

**Assessor accreditation:** 0017

### Improving or maintaining biodiversity

An application for a red flag determination is required for the following red flag areas

Red flag	Reason
Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin	Vegetation type being > 70% cleared; or it contains an endangered ecological community;

The application for a red flag determination should address the criteria set out in the BioBanking Assessment Methodology. Please note that a biobanking statement cannot be issued unless the determination is approved.

#### Additional information required for approval:

- ☐ Change to percent cleared for a vegetation type/s
- ☐ Use of local benchmark
- ☐ Change negligible loss
- ☐ Expert report
- ☐ Predicted threatened species not on site
- ☐ Change threatened species response to gain (Tg value)

## Ecosystem credits summary

Vegetation type	Area (ha)	Credits required	Red flag
Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin	1.58	118	Yes
Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin	1.15	74	Yes
Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin	0.68	44	Yes
Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin	1.50	87	Yes
<b>Total</b>	<b>4.91</b>	<b>323</b>	

## Credit profiles

### 1. Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin, (ME039)

Number of ecosystem credits required	323
CMA sub-region	Pittwater (Part B)
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
<p>Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin, (ME039)</p> <p>Scribbly Gum - Red Bloodwood heathy woodland on the coastal plains of the Central Coast, Sydney Basin, (HU610)</p>	<p>Pittwater (Part B)</p> <p>Clarence Lowlands</p> <p>Richmond - Tweed (Qld - Scenic Rim) (Part A)</p> <p>Murwillumbah (Qld - Southeast Hills and Ranges)</p> <p>Wollemi - Hawkesbury/Nepean</p> <p>Wollemi (Part A)</p> <p>Wollemi (Part B)</p> <p>Yengo - Hunter/Central Rivers</p> <p>Wyang</p> <p>Walcha Plateau - Northern Rivers</p> <p>Macleay Hastings - Hunter/Central Rivers</p> <p>Macleay Hastings - Northern Rivers</p> <p>Coffs Coast &amp; Escarpment</p> <p>Clarence Sandstones</p>

Jervis

Bungonia - Hawkesbury/Nepean

Sydney Cataract - Sydney Metro

Pittwater

Bateman

Illawarra

South East Coastal Ranges (Part C)

Ellerston

Upper Hunter

Kerrabee - Hunter/Central Rivers

Wollemi (Part C)

Stanthorpe Plateau

Species credits

Common name	Scientific name	Extent of impact	Number of species credits required
Powerful Owl	Ninox strenua	4.00	121



# BioBanking Credit Calculator



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## BioBanking credit report

This report identifies the number and type of credits required at a DEVELOPMENT SITE.

Date of report: 10/07/2013

Time: 10:18:29AM

Tool version: 2.0

### Development details

**Proposal ID:** 0017/2013/0717D

**Proposal name:** Northern Beaches Hospital1

**Proposal address:** Area bounded by Warringah Road, Bantry Bay Road & Frenchs Forest Road West  
Frenchs Forest NSW

**Proponent name:** Health Infrastructure

**Proponent address:** Level 8, 77 Pacific Highway North Sydney NSW

**Proponent phone:** (02) 9978 5402

**Assessor name:** Teresa James

**Assessor address:** 835 Caparra Road CAPARRA NSW 2429

**Assessor phone:** 6550 7311

**Assessor accreditation:** 0017

### Improving or maintaining biodiversity

An application for a red flag determination is required for the following red flag areas

Red flag	Reason
Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin	Vegetation type being > 70% cleared; or it contains an endangered ecological community;

The application for a red flag determination should address the criteria set out in the BioBanking Assessment Methodology. Please note that a biobanking statement cannot be issued unless the determination is approved.

#### Additional information required for approval:

- ☐ Change to percent cleared for a vegetation type/s
- ☐ Use of local benchmark
- ☐ Change negligible loss
- ☐ Expert report
- ☐ Predicted threatened species not on site
- ☐ Change threatened species response to gain (Tg value)

## Ecosystem credits summary

Vegetation type	Area (ha)	Credits required	Red flag
Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin	0.06	3	Yes
Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin	0.15	8	Yes
Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin	0.12	7	Yes
<b>Total</b>	0.33	18	

## Credit profiles

### 1. Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin, (ME039)

Number of ecosystem credits required	18
CMA sub-region	Pittwater (Part B)
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
<p>Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin, (ME039)</p> <p>Scribbly Gum - Red Bloodwood heathy woodland on the coastal plains of the Central Coast, Sydney Basin, (HU610)</p>	<p>Pittwater (Part B)</p> <p>Clarence Lowlands</p> <p>Richmond - Tweed (Qld - Scenic Rim) (Part A)</p> <p>Murwillumbah (Qld - Southeast Hills and Ranges)</p> <p>Wollemi - Hawkesbury/Nepean</p> <p>Wollemi (Part A)</p> <p>Wollemi (Part B)</p> <p>Yengo - Hunter/Central Rivers</p> <p>Wyong</p> <p>Walcha Plateau - Northern Rivers</p> <p>Macleay Hastings - Hunter/Central Rivers</p> <p>Macleay Hastings - Northern Rivers</p> <p>Coffs Coast &amp; Escarpment</p> <p>Clarence Sandstones</p> <p>Jervis</p> <p>Bungonia - Hawkesbury/Nepean</p>

Sydney Cataract - Sydney Metro

Pittwater

Bateman

Illawarra

South East Coastal Ranges (Part C)

Ellerston

Upper Hunter

Kerrabee - Hunter/Central Rivers

Wollemi (Part C)

Stanthorpe Plateau

Species credits

Common name	Scientific name	Extent of impact	Number of species credits required
Powerful Owl	Ninox strenua	0.33	10

# BioBanking Credit Calculator



Office of  
Environment  
& Heritage

## BioBanking credit report

This report identifies the number and type of credits required at a DEVELOPMENT SITE.

Date of report: 10/07/2013

Time: 10:24:35AM

Tool version: 2.0

### Development details

**Proposal ID:** 0017/2013/0718D

**Proposal name:** Northern Beaches Hospital2

**Proposal address:** Area bounded by Warringah Road, Wakeshurst Parkway & French Forest Road West  
Frenchs Forest NSW

**Proponent name:** Health Infrastructure

**Proponent address:** Level 8, 77 Pacific Highway North Sydney NSW

**Proponent phone:** (02) 9978 5402

**Assessor name:** Teresa James

**Assessor address:** 835 Caparra Road CAPARRA NSW 2429

**Assessor phone:** 6550 7311

**Assessor accreditation:** 0017

### Improving or maintaining biodiversity

An application for a red flag determination is required for the following red flag areas

Red flag	Reason
Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin	Vegetation type being > 70% cleared; or it contains an endangered ecological community;

The application for a red flag determination should address the criteria set out in the BioBanking Assessment Methodology. Please note that a biobanking statement cannot be issued unless the determination is approved.

#### Additional information required for approval:

- ☐ Change to percent cleared for a vegetation type/s
- ☐ Use of local benchmark
- ☐ Change negligible loss
- ☐ Expert report
- ☐ Predicted threatened species not on site
- ☐ Change threatened species response to gain (Tg value)

## Ecosystem credits summary

Vegetation type	Area (ha)	Credits required	Red flag
Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin	0.09	4	Yes
Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin	0.23	12	Yes
Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin	0.19	11	Yes
<b>Total</b>	0.51	27	

## Credit profiles

### 1. Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin, (ME039)

Number of ecosystem credits required	27
CMA sub-region	Pittwater (Part B)
Minimum percent native vegetation cover class	31-70%
Minimum adjacent remnant area class	>100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
<p>Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin, (ME039)</p> <p>Scribbly Gum - Red Bloodwood heathy woodland on the coastal plains of the Central Coast, Sydney Basin, (HU610)</p>	<p>Pittwater (Part B)</p> <p>Clarence Lowlands</p> <p>Richmond - Tweed (Qld - Scenic Rim) (Part A)</p> <p>Murwillumbah (Qld - Southeast Hills and Ranges)</p> <p>Wollemi - Hawkesbury/Nepean</p> <p>Wollemi (Part A)</p> <p>Wollemi (Part B)</p> <p>Yengo - Hunter/Central Rivers</p> <p>Wyong</p> <p>Walcha Plateau - Northern Rivers</p> <p>Macleay Hastings - Hunter/Central Rivers</p> <p>Macleay Hastings - Northern Rivers</p> <p>Coffs Coast &amp; Escarpment</p> <p>Clarence Sandstones</p> <p>Jervis</p> <p>Bungonia - Hawkesbury/Nepean</p>

Sydney Cataract - Sydney Metro

Pittwater

Bateman

Illawarra

South East Coastal Ranges (Part C)

Ellerston

Upper Hunter

Kerrabee - Hunter/Central Rivers

Wollemi (Part C)

Stanthorpe Plateau

Species credits

Common name	Scientific name	Extent of impact	Number of species credits required
Powerful Owl	Ninox strenua	0.51	15



## Appendix D

---

Biodiversity Specialist Report for Northern Beaches Hospital  
Site



# Northern Beaches Hospital Biodiversity Specialist Report

Prepared for Health Infrastructure

Date | 15 May 2013



**SMEC**

**ENVIRONMENT**





# **Northern Beaches Hospital Project**

# **Biodiversity Specialist Report**

**For: NSW Health Infrastructure**

**May 2013**

Project Name:	Northern Beaches Hospital Project
Project Number:	30011256
Report for:	NSW Health Infrastructure

## PREPARATION, REVIEW AND AUTHORISATION

Revision #	Date	Prepared by	Reviewed by	Approved for Issue by
0	15 May 2013	J. Anson/E. Broese/ K. Velthuis	B Tucker	C Masters

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# Executive Summary

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## **Background**

Health Infrastructure (HI) is managing the delivery of a new hospital at Frenchs Forest as part of the Northern Beaches Health Service redevelopment. The locality contains ecologically significant flora and fauna communities, including Duffys Forest Ecological Community (DFEC). This is a listed endangered ecological community under the *NSW Threatened Species Conservation Act 1995* (TSC Act).

As part of the process of obtaining planning approval under Part 5.1 of the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act), an ecological investigation has been undertaken into the likely and potential impacts of construction and operation of the proposed hospital, and to identify suitable measures to mitigate and manage the impacts.

This Biodiversity Specialist Report has been prepared to document the methodology employed and the findings of the investigation. Particular attention has been given to potential impacts on threatened species, populations and communities, listed under the TSC Act or the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), that occur or could occur in the area.

## **Existing environment**

The proposed hospital site is located within the Warringah local government area. It is bounded by Frenchs Forest Road West, Wakehurst Parkway, Warringah Road and The Forest High School. The surrounding area comprises a mix of development interspersed with remnant vegetation. The physiographic setting of the site is a broad ridge, in a higher rainfall, shale-sandstone transitional area of the Hornsby Plateau.

The proposed hospital site has been identified as part of an important regional corridor connecting large patches of remnant native vegetation to the north (Narrabeen Lagoon, Garrigal National Park), and to the south (Manly Warringah War Memorial Park, Forestville Park, Ararat Reserve). This has been identified as a Priority 1 Vegetation Corridor by Warringah Council.

## **Methodology**

The study area for the investigation focuses on the hospital site but also considers the surrounding area. The ecological investigation principally comprised three seasonal flora and fauna surveys of the proposed hospital site to account for seasonal variation. Surveys were designed to target threatened flora, fauna and ecological communities identified as occurring, or potentially occurring, within the study site. The Office of Environment and Heritage (OEHL) was consulted with regard to survey designs. The survey effort exceeded OEHL minimum recommendation guidelines for all fauna surveys. Flora surveys were undertaken according to NSW BioBanking methodology to quantify impacts and recommend appropriate mitigation measures.

## **Key survey findings**

The flora surveys confirmed the presence of DFEC across the majority of the site. In addition, a large number of hollow-bearing trees were recorded on the site. Hollows can provide valuable shelter and nesting habitat for mammal, bird, reptile and frog species.

No threatened flora species were identified on the site. However, the presence of two threatened fauna species were confirmed by the surveys, with the Grey-headed Flying-fox (*Pteropus poliocephalus*) and Powerful Owl (*Ninox strenua*) detected during fauna surveys. The extent of potential impacts resulting from the hospital development was assessed in relation to specific ecological information for each of these species. It was concluded that the development would be unlikely to have a significant impact on either species, and as such are not significant constraints to site development.

The study area contains good quality habitat suitable to sustain the viable population of Long-nosed Bandicoot (*Perameles nasuta*) identified on the site. This species is not listed as threatened under either NSW or Commonwealth legislation. Potential foraging and nesting habitat is available within the hospital site for two threatened fauna species: the Southern Brown Bandicoot (*Isodon obesulus*), listed as endangered under both NSW and Commonwealth legislation, and the Eastern Pygmy Possum (*Cercartetus nanus*), listed as vulnerable under NSW legislation. Targeted surveys for these two species were undertaken for the spring and summer surveys, however, neither of these species were identified on the site.

### **Summary and recommendations**

The principal ecological impact of the proposed hospital would be the removal of about 4.5 ha of DFEC. There would also be a loss of potential habitat for two threatened species, the Southern Brown Bandicoot and the Eastern Pygmy Possum. A resident population of Long-nosed Bandicoot would be impacted through loss of habitat. While two other threatened species (Grey-headed Flying-fox, Powerful Owl) may use the site, such as for foraging, the hospital development would not have a significant impact on them.

Based on the findings of the flora and fauna ecological surveys, the following mitigation strategies have been recommended for the Northern Beaches Hospital development:

- Retain DFEC where possible, such as parts of the vegetation along Wakehurst Parkway and Warringah Road
- Secure suitable offset areas and biobanking credits to improve and maintain biodiversity values consistent with the DFEC proposed to be cleared
- Soil translocation of DFEC topsoil to a suitable mitigation site along with logs and felled trees retained from the hospital site
- Minimise risk of introduction and spread of invasive species and disease by implementing control on the movement of vehicles and following appropriate managing protocols
- Translocation of existing Long-nosed Bandicoot population to reduce mortality caused by vegetation removal, habitat disturbance and interactions with traffic
- Maintenance and improvement of the existing wildlife corridor adjacent to the hospital site by ensuring it is free from development and management plans are in place to maintain ecological integrity and the creation of additional corridors to facilitate wildlife movements out of the study area and across the landscape
- Secure suitable offset areas to be managed for improving/maintaining suitable habitat for the Eastern Pygmy Possum consistent with habitat to be cleared in the hospital site.



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## TERMS AND ACRONYMS

Terms	Definition
Direct impacts	Impacts that directly affect habitat and individuals. They include, but are not limited to, death through predation, trampling, poisoning of the animal / plant itself and the removal of suitable habitat.
Indirect impacts	Occur when project related activities affect species, populations or ecological communities in a manner other than direct loss, such as soil erosion or weed invasion.
Local population	Of a <b>threatened plant</b> species, comprises those individuals occurring in the study area or the cluster of individuals that extend into habitat adjoining and contiguous with the study area that could reasonably be expected to be cross-pollinating with those in the study area. Of <b>resident fauna</b> species, comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area.
Locality	The area within a 10 kilometre radius of the subject site.
Offset strategy site	Remnant vegetation on the south-east corner of Aquatic Drive and Madison Way with a western boundary on Madison Way.
Sampling areas	A, B and C
Study area	The subject site and any additional areas likely to be affected by the Project, either directly or indirectly. Remnant vegetation bounded by Wakehurst Parkway, Warringah Road and Frenchs Forest Rd West (intersected by Bantry Bay Road), Frenchs Forest, NSW
Subject site	The area directly affected by the project.
Survey period	The three distinct survey periods: winter 2012, spring 2012, autumn 2013
The project	The development, activity or action proposed for the Northern Beaches Health Service.
Threatened biota	Threatened species, populations and ecological communities.

Acronyms	Definition
BBAM	BioBanking Assessment Method
CSSF	Coastal Shale Sandstone Forest
DEC	(Former) Department of Environment and Conservation (NSW)
DECC	(Former) Department of Environment Climate & Change (NSW)
DECCW	(Former) Department of Environment Climate Change & Water (NSW)
DFEC	Duffys Forest Ecological Community
DFI	Duffys Forest Index
DSEWPaC	Department of Sustainability, Environment & Water Protection & Conservation (Commonwealth)

Acronyms	Definition
EEC	Endangered Ecological Community
EP&A Act	<i>Environmental Planning and Assessment Act 1979 (NSW)</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)</i>
ESU	Environmental Sampling Unit
GIS	Geographic Information System
KTP	Key Threatening Process
LEP	Local Environmental Plan
LGA	Local Government Area
NBHS	Northern Beaches Health Services
NES	Matters of National Environmental Significance
OEH	Office of Environment and Heritage (NSW)
ROTAP	Rare or Threatened Australian Plants
RMS	Roads and Maritime Services (NSW)
S_DSFO4	Coastal Enriched Sandstone Sheltered Forest
S_DSFO9	Coastal Sandstone Apple-Peppermint Gully Forest
S_DSFI1	Hornsby Sandstone Exposed Bloodwood Woodland
S_DSFI4	Sydney Ironstone Bloodwood-Silvertop Ash Forest
S_WSF06	Coastal Shale-sandstone Forest
SABSF	Silvertop Ash-brown Stringybark Forest
SMCMA	Sydney Metropolitan Catchment Management Authority
SMEC	Snowy Mountains Engineering Corporation
SSGF	Sydney Sandstone Gully Forest
SSI	State Significant Infrastructure
SSRW	Sydney Sandstone Ridgetop Woodland
TEC	Threatened Ecological Community
TSC Act	<i>Threatened Species Conservation Act 1995 (NSW)</i>

# I Introduction

---

## I.1 Background

NSW Health Infrastructure (HI) commissioned SMEC Australia to undertake ecological investigations into the proposed Northern Beaches Hospital (the project).

The project is located within Frenchs Forest where ecologically significant flora and fauna communities exist, including Duffys Forest Endangered Ecological Community (EEC). As part of the project, SMEC has undertaken biodiversity surveys targeting threatened species that potentially occur in the area. This was undertaken in two stages:

- Desktop investigation and survey concept design.
- Systematic flora and fauna surveys and habitat assessment (June 2012, October 2012 and February 2013), culminating in this Biodiversity Specialist Report. Flora surveys were undertaken in accordance with the NSW BioBanking Assessment Method (BBAM).

This Biodiversity Specialist Report is a summary and analysis of the ecological investigations carried out during 2012 and 2013.

## I.2 Project description

The project comprises the delivery of a new hospital for health services by the Northern Beaches Health Service (NBHS) to the Northern Sydney Local Health District. The NSW government has made a number of key commitments to the project. The project has regional benefits to the Northern Beaches area through the provision of community health facilities and local impacts including the preservation of ecological areas and ecological connectivity.

## I.3 Study area

The study area is located in Frenchs Forest, approximately 15 kilometres from the Sydney CBD. The study area is situated along Bantry Bay Road bound by Wakehurst Parkway, Warringah Road and Frenchs Forest Road West. The study area is owned by the Department of Health. The study area has high biodiversity value, and is recognised as potential habitat for threatened species and ecological communities, forming part of an important vegetated wildlife corridor. A large portion of this site contains intact vegetation identified as Duffys Forest EEC (Smith and Smith 2000) listed under the *Threatened Species Conservation Act 1995* (TSC Act).

A potential offset site is located to the south-east of the study area, and includes the remnant vegetation on the south-east corner of Aquatic Drive and Madison Way, with the western boundary on Madison Way.

## I.4 Legislative context

The site of the proposed Northern Beaches Hospital is within the 'Northern Beaches Hospital Precinct'. The precinct was established through the effect of Order 2012 No. 537, dated 16 October

2012, made under Section 115U(4) of the *Environmental Planning and Assessment Act 1979* (EP&A Act), that amended Schedule 4 to *State Environmental Planning Policy (State and Regional Development) 2011*. This defined the precinct and designated any development proposed by, or on behalf of a public authority, with a capital investment value of over \$30 million within the precinct, to be State Significant Infrastructure (SSI).

This Biodiversity Specialist Report has been prepared to support consideration the potential environmental impact of the project on ecological values, as required under Part 5.1 of the EP&A Act. Particular attention has been given to potential impacts on threatened species, populations and communities, listed under the TSC Act or the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), that occur or could occur in the study area.

## 1.5 Study aims

The key aims of this study are to:

- Undertake a review of published documentation and a desktop study of flora and fauna relevant to the study area, identifying species or communities that may be present.
- Conduct seasonal ecological survey of the study area, with particular attention to impacts on species regarded as listed under the TSC Act and the EPBC Act.
- Identify and assess likely impacts on the flora and fauna arising from the project.
- Undertake assessments under Section 5a of the EP&A Act and the EPBC Act with tests of significance for threatened biota where required.
- Identify mitigating measures for managing impacts on threatened biota during construction and operation as appropriate.



## 2 Methodology

---

### 2.1 Personnel

The biodiversity field surveys were undertaken by SMEC ecologists, principally Dr Liz Broese, Dr Tom Newsome, Kirsten Velthuis and Dr Jennifer Anson. Other SMEC staff provided field support under the direction of the lead ecologist on site.

### 2.2 Database searches and literature reviews

Desktop research was undertaken prior to the commencement of field surveys and included database searches and a review of relevant literature to determine if targeted surveys for specific species were required. Additionally these searches helped to identify threatened biota known or likely to occur in the study area.

The following databases were interrogated:

- NSW Office of Environment and Heritage (OEH) Atlas of NSW Wildlife Database within a 10 kilometre radius of the site
- Protected Matters Report that documents all Matters of National Environmental Significance (NES) within 10 kilometres of site; NES include threatened species, communities and migratory species which are listed under the EPBC Act (Department of Sustainability, Environment, Water, Population and Communities)
- NSW Flora Online Search – Rare or Threatened Australian Plants (ROTAP) species (The Royal Botanic Gardens and Domain Trust 2012)
- NSW Office of Environment and Heritage (2012), Vegetation Types Database, Vegetation Benchmarks Database, Threatened Species Profile Database
- DECCW (2009a), The Native Vegetation of the Sydney Metropolitan Catchment Management Authority Area. Department of Environment and Climate Change NSW, Hurstville
- Warringah Council mapping – 2013 Draft revised Wildlife Corridors and Draft Core Habitats.

Systematic site-based survey methods were developed following a review of the OEH guidelines *Threatened Species Survey and Assessment: Guidelines for developments and activities* (working draft) (DEC 2004) and a preliminary site inspection in June 2012.

### 2.3 Field survey

Based on desktop and on-ground assessments, seasonal flora and fauna surveys commenced in June 2012, targeting threatened species that occurred, or were likely to occur, within the proposed site. The systematic flora and fauna surveys and habitat assessments were undertaken in accordance with, and in many cases exceeded, OEH recommendations (DEC 2004).

For flora, methods included transect survey and vegetation plots where the name of each species was recorded, as well as a cover and abundance and other criteria in accordance with the NSW

BBAM. Fauna sampling targeted birds, ground dwelling and arboreal mammals, bats, reptiles and frogs. Fauna survey methods included trapping and release of the target species and survey counts of birds. Spotlighting and broadcasting of owl and frog calls also took place at night time to target nocturnal species.

### *2.3.1 Flora surveys*

Flora surveys were conducted in three discrete sampling areas (A, B and C, refer Figure 1). The winter flora surveys were undertaken according to methodology outlined in the Vegetation Type Standard (DECCW 2009a). Following discussion with OEH, the spring flora surveys were undertaken according to NSW BioBanking methodology (DECC 2009b). Site value data was collected using 50 m transects and Vegetation Type Standard methodology for systematic floristic survey using 20 m x 20 m plots.







Other information recorded at each sampling site included physical characteristics such as slope, aspect and lithology.

### 2.3.2 Survey stratification

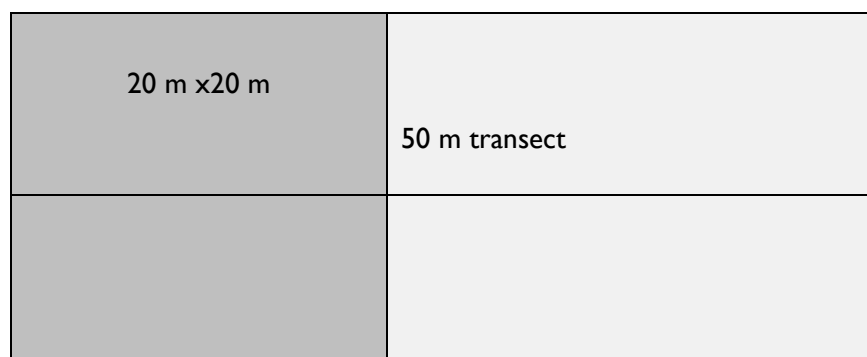
The initial delineation of environmental sampling units (ESUs) within these areas was based on mapping done by Smith and Smith 2000. Areas A and B were divided into three ESUs as follows:

- Older regrowth (relatively dense canopy cover)
- Post-fire regrowth (relatively sparse canopy cover)
- Weed dominated patches (canopy cover variable).

Area C was divided into two ESUs as follows:

- Older regrowth (dense canopy cover)
- Weed-dominated margins (canopy cover variable).

Plots with dimensions of 20 m x 50 m (including the 20 m x 20 m plots and 50 m transects) were established in each ESU in Areas A, B and C (Figure 2).



**Figure 2 Survey plot and transect layout to assess vegetation site value variables**

### 2.3.3 Systematic floristic survey

Full floristic 20 m x 20 m plots were used to record species, per cent cover, abundance, stratum and growth form. Species composition and cover were used to help determine vegetation type by comparison with descriptions of known vegetation types in the Sydney Metropolitan Catchment Management Authority (SMCMA) and definitions of Duffys Forest Ecological Community (DFEC) (Smith and Smith 2000, NSW Scientific Committee 2011).

### 2.3.4 Site Value transects

Fifty-metre transects within the larger 20 m x 50 m plot were used to provide detailed information on condition of vegetation following BioBanking methodology (DECC 2009b).

Site Value data recorded in the 50 m transect:

- Native and exotic plant species richness
- Native and exotic grasses ground cover

- Native and exotic subshrubs ground cover
- Native and exotic 'other' ground cover
- Native and exotic midstorey cover
- Native and exotic overstorey cover.

Site Value data recorded in the larger 20 m x 50 m plot at each site:

- Proportion of overstorey species occurring as regeneration
- Total length of fallen logs.

### 2.3.5 Targeted searches for hollow-bearing trees and threatened flora

The number and location of trees with hollows were recorded across the study area (sampling areas A, B and C) in conjunction with targeted searches for *Grevillea caleyi*, any observed occurrence of laterite nodules on the site, and other potentially occurring threatened flora species.

### 2.3.6 Fauna surveys

The study area was divided into three discrete sampling areas (A, B & C), with surveying conducted within each area over a four night period per survey (Figure 3).

#### **Birds**

Area searches with a species time curve were used to survey diurnal bird species during their peak activity time, usually at dawn. Three bird surveys were conducted per day of each survey period, one at each of the discrete sampling areas.

Owl species are territorial but are difficult to detect because they are nocturnal and often have large home ranges. However, owl species readily respond to taped recordings of conspecifics, if they are near the broadcast point and if the calls are played loud and long enough for them to hear. Call playback recordings of the Bush Stone Curlew (*Burhinus grallarius*) and four owl species; Powerful Owl (*Ninox strenua*), Barking Owl (*Ninox connivens*), Masked Owl (*Tyto novaehollandiae*) and Sooty Owl (*Tyto tenebricosa*) were broadcast using a loud speaker and followed by a 10-15 minute period of listening for response calls, followed by further localised spotlight searches and subsequent intermittent call playback at one site for four nights. In addition, habitat searches were conducted throughout the day for suitable roosting trees and nest sites.

#### **Bats**

Bats were targeted during the warmer months (November – March) and surveyed in spring 2012 and autumn 2013. Acoustic surveys were undertaken with an Anabat II ultrasonic detector and attached ZCAIM. Surveys were undertaken all night (eight hours) at each site to maximise species detection. Sonograms were reviewed with Analook for Windows v0.3.3.1.7 and identified using the guidelines and reference library in Pennay *et al* (2004).



**LEGEND**

- Study site
- Study areas
- Arboreal Traps
- Cage Traps
- Pitfall Traps
- Elliott Traps
- Cage Traps



DATE 05/07/2012

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COORDINATE SYSTEM  
GDA 1994 MGA Zone 56

FIG NO. 3

FIGURE TITLE Stratified fauna sampling design

PROJECT NO. 30011256

PROJECT TITLE Northern Beaches Hospital

CREATED BY RC10721

SOURCES Bing Maps



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Sonograms were classified into three different confidence levels of identification: Confident (C), Probable (Pr) and Possible (Po). Trapping of individuals using two harp traps was also used to supplement the Anabat survey. Trapping was conducted over a four night period for each of the two warmer survey periods. The trapping techniques targeted the six threatened bat species with potential to occur in the study area (Appendix 3).

### **Reptiles**

Reptiles were targeted for survey during the warmer months (November – March). Two pitfall traps with 10 m long drift fences were established in each of the three sampling areas and opened for four nights for each of the spring 2012 and autumn 2013 surveys. Any reptiles, amphibians or small mammals captured were identified and removed from the traps at dawn. In addition, active searches for reptiles in targeted habitat were undertaken. This sampling intensity matched OEH (DEC 2004) guideline requirements.

### **Amphibians**

The threatened Red-crowned Toadlet (*Pseudophryne australis*) were targeted for survey in the warmer months (November – March). Two pitfall traps (as above) were established in each of the three sampling areas and opened for four nights for each of the spring 2012 and autumn 2013 surveys. Any amphibians captured were identified and removed from the traps at dawn. In addition, call playback and aural surveys were undertaken at nights along with diurnal active searches for the Red-crowned Toadlet in targeted habitat. This sampling intensity matched OEH (DEC 2004) guideline requirements.

### **Mammals**

Small-medium sized mammals were surveyed using pitfall trapping (as above), Elliott traps A (30 x 10 x 8 cm), ground cage traps (210 x 165 x 490 mm), arboreal cage traps (210 x 165 x 490 mm), and spotlighting for four continuous nights per survey period. Each of the three sampling areas had two pitfall traps, four arboreal cage traps, 16 ground cage traps and 25 Elliott traps (Figure 3). This sampling intensity exceeded OEH (DEC 2004) guideline requirements. In addition, the spring and summer surveys were extended to include an additional four nights of ground trapping to specifically target bandicoots that could potentially occur.

Within the sampling areas arboreal traps were spaced approximately 100 m apart in a linear strip and mounted two metres above the ground in suitable mature trees. A mixture of honey/water was sprayed above the trap to attract animals. Elliott traps were spaced approximately 10 m apart on the ground in a linear strip. Elliott and arboreal traps were baited with a mixture of rolled oats, peanut butter and honey.

In each sampling area two linear sets of eight ground traps each were placed approximately 40 m apart and alternatively baited with either a mixture of rolled oats/peanut butter/honey or oats/peanut butter/anchovies to target different species of ground mammals. All traps had waterproof coverings, shade cloth and bedding to minimise risk to captured animals.

All captured individuals were identified and sexed if possible. In the initial survey period (winter 2012), all bandicoots were marked for identification using permanent marker (ring around the base of the tail) to establish if individuals were recaptured. In the subsequent survey periods (spring 2012,



and summer 2013) bandicoots were implanted subcutaneously with a uniquely numbered passive integrated transponder (PIT) tag for electronic monitoring of individuals and numbers.

In addition to trapping, spotlight surveys were used to further monitor mammals, nocturnal birds, bats and reptiles. Four surveys were conducted within each of the three sampling areas (A, B and C). Transects were approximately 250 m long and were surveyed for a minimum of 20 minutes. This sampling intensity exceeded OEH (DEC 2004) guideline requirements.

### **Observations**

Observational data recorded included weather conditions, species observed and distance off transect. This information can be used to provide density estimates via distance sampling for replicates obtained over the three survey periods.

Opportunistic fauna sighting and identification of predator scats and mammal markings have also been included in this Biodiversity Specialist Report.

## **2.4 Survey effort**

Three discrete site surveys were conducted:

- Winter (June 2012)
- Spring (October 2012)
- Summer/autumn (March 2013).

### *2.4.1 Flora survey effort*

Flora surveys, following the methodology above, were conducted in the winter and spring surveys. Where threatened species were detected, specific searches were performed to quantify the extent of distribution.

Three plots and three transects (50 m) were sampled during winter survey (one in each sampling area). An additional nine plots and nine transects (50 m) were surveyed in these areas in the spring survey.

### *2.4.2 Fauna survey effort*

Each of the three fauna surveys consist of sampling over four consecutive nights, with a total sampling effort of 12 nights (Table 1). The spring and summer surveys were extended to include an additional four nights of ground trapping, targeting bandicoots for a total of 384 trap nights during each of these survey periods.



**Table 1 Sampling effort for fauna surveys for proposed Northern Beaches Hospital, Frenchs Forest**

Survey technique	Target species	Survey	Winter 2012		Spring 2012		Autumn 2013		Total
			Dates	Survey effort	Dates	Survey effort	Dates	Survey effort	
Area search	Diurnal birds	Each sampling area (3) for four (4) nights	18/06/2012-22/06/2012	12 surveys	15/10/2012-19/10/2012	12 surveys	19/02/2013-22/02/2013	12 surveys	36 surveys
Call playback	Nocturnal birds (Owls)	40 minute searches per night (4)	18/06/2012-22/06/2012	4 surveys	15/10/2012-19/10/2012	4 surveys	18/02/2013-21/02/2013	4 surveys	12 surveys
	Red-crowned Toadlet	15 minute searches per night	-	-	15/10/2012-19/10/2012	4 surveys	18/02/2013-21/02/2013	4 surveys	8 surveys
Anabat	Bats	Potential habitat within sampling area for four (4) nights	-	-	15/10/2012-19/10/2012	4 surveys	18/02/2013-21/02/2013	3 surveys	7 surveys
Pitfall trapping	Reptiles / Small mammals / Amphibians	2 pitfall lines for each sampling area (3) for four (4) nights	-	-	15/10/2012-19/10/2012	12 surveys	26/02/2013-01/03/2013	12 surveys	24 surveys
Small Elliott traps	Small mammals	25 traps per sampling area (3) for four (4) nights	18/06/2012-22/06/2012	300 trap nights	15/10/2012-19/10/2012	300 trap nights	19/02/2013-22/02/2013	300 trap nights	900 trap nights
Cage traps	Ground mammals	16 traps per sampling area (3) for four (4) nights	18/06/2012-22/06/2012	192 trap nights	15/10/2012-19/10/2012 and 22/10/12 – 26/10/12	384 trap nights	19/02/2013-22/02/2013 and 26/02/2013-01/03/2013	384 trap nights	960 trap nights
Arboreal cage traps	Arboreal mammals	4 traps per sampling area (3) for four (4) nights	18/06/2012-22/06/2012	48 trap nights	15/10/2012-19/10/2012	48 trap nights	19/02/2013-22/02/2013	48 trap nights	144 trap nights
Spotlighting	Mammals/ Reptiles / Nocturnal birds / Bats	20 minute search per sampling area (3) for four (4) nights	18/06/2012-22/06/2012	240 minutes	15/10/2012-19/10/2012	240 minutes	18/02/2013-21/02/2013	240 minutes	720 minutes

## 2.5 BioMetric benchmarks

The comparisons of values recorded for site variable at each plot with BioMetric benchmarks for mapped vegetation types (Gibbons *et al* 2008) were used to generate a set of scores used to assess condition of vegetation. Scores for plots sampled in the spring survey are presented in Table 2. Variables with measured values within the benchmark range receive the highest score of three. Variables that were either below or above the benchmark range were given lower scores ranging from zero to two, eg, variables with values between 50 per cent and 100 per cent of the lower benchmark or between 100 per cent and 150 per cent of the benchmark for foliage cover values received a score of two.

Data recorded in the 50 m site value transects provided an objective means of assessing condition of vegetation on the study area. The comparisons of these site values with BioMetric benchmarks for mapped vegetation types (Table 3) were used to generate condition scores (Table 2, Gibbons *et al* 2008).

These scores provide a measure of site condition. Variables with measured values within the benchmark range receive the highest score of three. Variables that were either below or above the benchmark range were given lower scores ranging from zero to two, eg variables with values between 50 per cent and 100 per cent of the lower benchmark, or between 100 per cent and 150 per cent of the benchmark for foliage cover values received a score of two.

**Table 2 Criteria used to calculate BioMetric benchmark scores<sup>1</sup>**

Variable	Site Value Scores			
	0	1	2	3
Native plant species richness	0	>0-<50% of benchmark	50-<100% of benchmark	≥ benchmark
Native over-storey cover	0-10% or >200% of benchmark	>10-<50% or >150-200% of benchmark	50-<100% or >100-150% of benchmark	Within benchmark range
Native mid-storey cover	0-10% or >200% of benchmark	>10-<50% or >150-200% of benchmark	50-<100% or >100-150% of benchmark	Within benchmark range
Native ground cover (grasses)	0-10% or >200% of benchmark	>10-<50% or >150-200% of benchmark	50-<100% or >100-150% of benchmark	Within benchmark range
Native ground cover (shrubs)	0-10% or >200% of benchmark	>10-<50% or >150-200% of benchmark	50-<100% or >100-150% of benchmark	Within benchmark range
Native ground cover (other)	0-10% or >200% of benchmark	>10-<50% or >150-200% of benchmark	50-<100% or >100-150% of benchmark	Within benchmark range
Exotic plant cover (% of total ground and mid-storey cover)	>66%	<33-66%	<5-33%	0-5%
Number of trees with hollows	0 (unless benchmark includes 0)	>0-<50% of benchmark	50-<100% of benchmark	≥ benchmark
Total length of fallen logs	0-10% of benchmark	>10-<50% of benchmark	50-<100% of benchmark	≥ benchmark

<sup>1</sup> Gibbons et al (2008). *A Terrestrial Biodiversity Assessment Tool for the NSW Native Vegetation Assessment Tool (formerly Property Vegetation Plan Developer) Operational Manual*. NSW Department of Environment and Climate Change c/ CSIRO Sustainable Ecosystems

**Table 3 Benchmark criteria for candidate vegetation types on the study area**

BioMetric vegetation type	SMCMA vegetation type code	Number of native species	Overstorey cover	Midstorey cover	Native grass cover	Native subshrub cover	Native 'other' cover	Trees with hollows	Length of fallen logs
Red Bloodwood - Smooth-barked Apple	S_DSF14, S_DSF11, S_WSF06,	>40	10 to 45	17 to 52	0 to 24	0 to 10	0 to 24	>1	>30
Smooth-barked Apple - Red Bloodwood - Sydney Peppermint	S_DSF04	>34	28 to 33	44 to 54	1 to 10	6 to 10	11 to 15	>1	>30
Sydney Peppermint - Smooth-barked Apple	S_DSF09	>36	14 to 29	22 to 37	1 to 10	7 to 17	14 to 24	>1	>30

## 3 Existing environment

### 3.1 Landscape context

The study area is located within the Warringah local government area (LGA), Sydney and is located on a higher rainfall, shale-sandstone transitional area of the Hornsby Plateau. The site is located on higher land (150-160 m above sea level) comprising a mostly flat plateau surface. Areas A & B: Site levels tend to fall in a south easterly direction with an average fall of about five degrees. Area C: Site levels tend to fall in a north-easterly direction with average slopes of about 5-10 degrees. Steeper slopes and sandstone gullies occur to the north and south of the site and ridge-line associated with creek systems including Curl Curl Creek, Carroll Creek and Middle Creek.

The soil landscape of Lucas Heights indicates that the site is underlain by a thick shale (three to five metres thick) and interbedded laminates within Hawkesbury Sandstone at about 10-11 m depth under Areas A and B, and at 4 m depth in the north east corner of Area C (Sydney 1:100 000 Series Geological Sheet).

The soil profile observed along Frenchs Forest Road West indicates a relatively deep silty clay and clay (1-2 m depth) consistent with Mittagong Formation geology occurring between shale and sandstone strata. Laterite bands and ironstone gravel was recorded in boreholes drilled for geotechnical investigation for the Northern Beaches Hospital Project (Table 4, Douglas Partners 2012). Small fragments of surface ironstone gravel were observed on site but are rarely concentrated (James 2013). Sandstone outcrop is absent on the site except in the vicinity of northern sections of Wakehurst Parkway.

**Table 4 Summary of subsurface borehole soil / rock profiles (modified from Douglas Partners, 2012)**

Stratum	Depth (m)	Laterite/Ironstone	Level (mAHD)	Description
Pavement, filling, topsoil (mostly dk brn silty clay)	0	None recorded in boreholes.	RL 154.8-160.8	Asphaltic concrete, concrete, topsoil and siltyclay filling in most boreholes
Residual clay	0.2-1.1 m	ironstone gravel mainly in southern half of site; one site with shallow ironstone in northern part of Area B.	RL 154.8-160.6	Stiff to hard residual clay and shaly clay
Weathered shale	No shale NE corner borehole Area C 1.3-2 m Area B 2-3.5 m Areas A & C	ironstone bands mainly in southern part of site	RL 153.7-158.3	Extremely low and very low strength weathered shale

Stratum	Depth (m)	Laterite/Ironstone	Level (mAHD)	Description
Laminite/Siltstone	2 m Area B (NE corner) 5-6 m Area C 6-8 m Areas A & B		RL 150.1-154.7	Low to medium strength laminate/siltstone
Sandstone	4.2 m NE corner Area C 10.7 m Areas A & B		RL 148.3-152.1	Medium and high strength sandstone.

## 3.2 Land use

The study area lies within a heavily urbanised area of Sydney interspersed with remnant vegetation. The site comprises:

- A forest reserve with public access and walking paths.
- NSW Health land, including former residential properties along Bantry Bay Road (since demolished); at the time of commencement of the study, the only remaining building on the site was a community health services building and car park.

The site is surrounded by residential land, a local high school and is bordered by two multiple lane main roads. A smaller residential street intersects the site between the health service and where the residential houses have been removed. Currently, part of the site is fenced off to the public.

## 3.3 Vegetation communities and habitat

Native vegetation in the study area comprises a mosaic of open-woodland to open-forest with a dominant regenerating shrub layer in more recently disturbed parts and a well-developed shrub-sedge dominated ground layer elsewhere. Canopy species are variable across the site with *Angophora costata* the most common and widespread species. *Eucalyptus umbra*, *E. sieberi* and *Corymbia gummifera* occur at moderate frequencies in higher parts (northern part of Area A) with *E. resinifera*, *E. globoidea* and *E. capitellata* more localised. Vegetation in the study area reflects underlying geology with shale three to six metres thick across most of the site (presence of Red Mahogany and White Stringybark) and a small patch with sandstone influence in the north east of Area C (presence of Scribbly Gum). High levels of weed invasion are evident along the perimeter of the site, along tracks and in the vicinity of previous dwellings (James 2013).

Smith and Smith (2000) mapped the vegetation on the study area as Silvertop Ash-Brown Stringybark Forest, the most common form of Duffys Forest Ecological Community. They describe the condition as poor, mainly due to fragmentation by roads, houses and clearings:

‘It is very weedy, especially on the edges and in clearings. In the prolonged absence of fire (estimated 20+ years), a dense understorey of *Pittosporum undulatum* and *Allocasuarina littoralis* has developed in some parts of the stand to the detriment of other native species. Disturbance from occupation of part of site by a homeless man for some years has resulted in extensive rubbish dumping, many small fires and other disturbance to the vegetation. Parts of the stand are regenerating after past clearing and have only a sparse tree layer’.

There appears to be little change in the condition of the site since it was surveyed by Smith and Smith over 12 years ago. Currently, the canopy layer in the post-fire regrowth areas is sparse and dense stands of *Pittosporum undulatum* and *Allocasuarina littoralis* are still present in the older regrowth patches. There has been no change to management of the site and the ongoing disturbance due to occupation of the site by squatters only ceased in mid 2012.

Vegetation at the study site is mapped as Coastal Shale-Sandstone Forest in the Draft SMCMA mapping (DECC 2009a). Some stands of this forest have previously been recognised as a variant of Duffys Forest Ecological Community (Smith and Smith 2000). Duffys Forest Ecological Community (DFEC) grades into Coastal Shale-sandstone Forest, where ironstone deepens and erodes to clay soil. Alternatively it grades to sandstone forests, woodlands or heaths, depending on adjoining aspect, as well depth and rockiness of soil (DECC 2009a).

A full list of flora recorded within the study area is provided in Appendix 1, vegetation community descriptions are provided in Appendix 2.

Diagnostic floristic comparisons were undertaken using the Duffys Forest Index (Smith and Smith 2000) and a detailed comparison of SMCMA vegetation types Appendix 7 to test for DFEC in the study area. Results of the diagnostic comparisons have been independently verified by an expert botanist, Teresa James (James 2013).

Location, topographic position, underlying geology and soils have also been considered for determining vegetation types observed in the study area. DFEC occurs on ridgetops and plateaus in a variety of Soil Landscapes: Somersby, Blacktown Lucas Heights, Lambert and, to a lesser extent, Gynea and Hawkesbury. In terms of Walker's (1960) classification of Sydney soils, Duffys Forest vegetation occurs on the Woronora, Hammondville, Hawkesbury and Wahroonga Soil Associations (Smith and Smith 2000).

### 3.4 Threatened ecological communities

A search of the NSW Flora Online (The Royal Botanic Gardens and Domain Trust 2012), Protected Matters databases (DSEWPaC 2012) and Atlas of NSW Wildlife (OEH 2012) identified five Threatened Ecological Communities (TECs) that have been recorded, or could occur in similar habitats, within a 10 km radius of the study area (Appendix 3) (refer Figure 4).

Four of these TECs are listed under both the TSC Act and EPBC Act:

- Blue Gum High Forest of the Sydney Basin Bioregion
- Eastern Suburbs Banksia Scrub of the Sydney Region
- Littoral Rainforest and Coastal Vine Thickets of Eastern Australia
- Turpentine-Ironbark Forest in the Sydney Basin Bioregion.

Additionally, Duffys Forest Ecological Community is listed as endangered under the NSW TSC Act, but not under the Commonwealth EPBC Act.







## 3.5 Threatened species and endangered populations

### 3.5.1 Flora – database search

A search of the NSW Flora Online (The Royal Botanic Gardens and Domain Trust 2012), Protected Matters databases (DSEWPaC 2012) and Atlas of NSW Wildlife (OEH 2012) identified 49 threatened flora species, with 45 species listed under the TSC Act and 24 flora species listed under the EPBC Act that occur, or have habitat occurring within a 10 km radius of the study area. The likelihood that the threatened flora species occur within the study area is assessed in Appendix 3.

### 3.5.2 Fauna – database search

A search of the NSW OEH Atlas of NSW Wildlife database (OEH 2012) and Protected Matters database (DSEWPaC 2012) identified 67 threatened fauna species that have been recorded, or could occur in similar habitats, within a 10 km radius of the Study area. Sixty-two of these fauna species are listed under the TSC Act and 29 species listed under the EPBC Act and includes; 44 bird species including several migratory birds, 16 mammal species, two reptiles and five species of frogs. The likelihood that the threatened fauna species occur within the study areas is assessed in Appendix 3.

## 3.6 Flora survey results

### 3.6.1 Flora: Survey 1 (Winter 2012)

Three 20 m x 20 m plots and 50 m transects were surveyed on the study area in winter: one plot in each Area A, B and C (see Figure 5 for plot locations). The winter 2012 survey recorded 61 flora species, including ten (10) exotic species (Appendix 1). Of the exotic species, eight are listed as noxious weeds in the Warringah LGA: Black Bamboo, Cape Ivy, Lantana, Large-leaved and Small-leaved Privet, Ochna, Pampas Grass and Tussock Paspalum. None of the 49 threatened flora species identified in the desktop survey were observed at the study area during the first survey.

The potential offset site (two hectares) at the junction of Aquatic Drive and Madison Way has also been mapped as Coastal Shale Sandstone Forest. This site is highly disturbed vegetation around a cleared grassy patch (0.5 ha) in the middle of the site. The cleared grassy area overlies imported fill. A two metre high bank along the southern edge of the fill has been planted with native shrubs and trees (Tallowwood, *Eucalyptus microcorys*) to stabilise the bank. The northern and western sides of the patch are dominated by weeds such as Lantana and Buffalo Grass. The least disturbed section in the south west corner shared many native species in common with nearby good condition patches of DFEC in Madison Way.

A full list of flora recorded within the study area is provided in Appendix 1. Vegetation community descriptions are provided in Appendix 2.

## Description of vegetation in Area A



**Plate I Area A post fire regrowth**

i) Older regrowth:

Open forest: tree canopy dominated by Smooth-barked Apple (*Angophora costata*) and Broad-leaved White Mahogany (*Eucalyptus umbra*); mid stratum is patchy, generally sparse shrub layer dominated by wattles, and denser patches of *Pittosporum* and *Allocasuarina*. The ground layer is dense, dominated by sedges (*Gahnia* spp.) and grass, Wiry Panic (*Entolasia stricta*). Vegetation in this ESU is relatively weed free.

ii) Post-fire regrowth:

Shrubby woodland: sparse canopy layer with regrowth Smooth-barked Apple and Broad-leaved White Mahogany; patches of dense shrubby regrowth tea-tree (*Leptospermum trinervium*) with sparse Black She-oak (*Allocasuarina littoralis*). The ground layer is patchy with sparse sedge dominated areas under dense tea-tree, and dense sedge / grass cover in more open patches. Vegetation in this ESU is relatively weed free.

iii) Weed-dominated patches:

Weed dominated areas are generally found around the margins of the study area and along well used tracks and paths criss-crossing the site. Exotic species dominate the mid stratum (such as Privet, Lantana and Cotoneaster) and ground stratum (such as Tussock Paspalum, Whiskey Grass, Kikuyu). The canopy is predominately native with Smooth-barked Apple and Broad-leaved White Mahogany.



Sydney Blue Gum (*E. saligna*) and Swamp Mahogany (*E. robusta*) also occur around the margins. Some of the largest trees on the study area are in these weed dominated margins.

### **Description of vegetation in Area B**



### **Plate 2 Area B older regrowth**

#### **i) Older regrowth:**

Open forest: tree canopy dominated by Smooth-barked Apple and Broad-leaved White Mahogany with Black She-oak and Red Bloodwood (*Corymbia gummifera*); diverse mid-dense shrub layer with tea-trees, wattles, geebungs and native daphne; dense ground layer is dominated by sedges and rushes (*Caustis* and *Lomandra* spp) and grass (Wiry Panic).Vegetation in this ESU is relatively weed free.

#### **ii) Post-fire regrowth:**

Shrubby woodland: sparse canopy layer with regrowth Smooth-barked Apple and Broad-leaved White Mahogany; a low tree layer with patches of regrowth Green Wattle (*Acacia irrorata*) and Black She-oak; mid-dense shrub layer of tea-trees, wattles, geebungs and native daphne; dense ground layer dominated by sedges, rushes and grasses. Vegetation in this ESU is relatively weed free.

#### **iii) Weed-dominated patches:**

Weed dominated ares are generally found around the margins of the study area and along well used tracks and paths criss-crossing the site. Exotic species dominate the mid statum (such as Privet,



Lantana, Ochna, Cotoneaster and Black Bamboo) and ground stratum (such as Tussock Paspalum, Whiskey Grass, Kikuyu). The canopy is predominately native with Smooth-barked Apple and Broad-leaved White Mahogany.

### **Description of vegetation in Area C**



### **Plate 3 Area C older regrowth**

#### **i) Older regrowth**

Open forest: Tree canopy dominated by Smooth-barked Apple and Broad-leaved White Mahogany; diverse mid-dense shrub layer dominated by wattles; dense ground layer dominated by native sedges and grasses. Vegetation in this ESU is relatively weed free.

#### **ii) Weed-dominated patches**

Weed dominated areas are generally found around the margins of the study area. Exotic species dominate the mid stratum (such as Privet and Lantana) and ground stratum (such as Buffalo Grass, Pampas Grass, Kikuyu). The canopy is predominately native with Smooth-barked Apple and Broad-leaved White Mahogany. Sydney Blue Gum and Swamp Mahogany also occur around the margins. Some of the largest trees in the study area are in these weed dominated margins.







### 3.6.2 Flora: survey 2 (Spring 2012)

In spring 2012 an additional nine plots and transects were surveyed (Appendix 2, Figure 5). One hundred and forty-six flora species were recorded, including 30 exotic species (Appendix 1).

#### **Targeted search for threatened flora (*Grevillea caleyi*)**

No *Grevillea caleyi* were found on the site during intensive targeted searches across the study area (see Figure 6 showing GPS track of random search path). In addition, none of the 49 threatened flora species identified in the desktop survey were observed at the study area during the second survey in spring.

A number of regionally and locally significant species (Smith and Smith 2000) were recorded on the site: *Deyeuxia decipiens*, *Gahnia radula*, *Prostanthera denticulata*, *Pultenaea hispidula* and *P. scabra* var. *biloba*, *Eucalyptus umbra* and *Gahnia erythrocarpa*.

#### **Hollow-bearing trees and stags**

A survey of hollow-bearing trees and stags was undertaken during the spring survey, recording species, GPS coordinates, and number of small, medium and large hollows. Forty-seven hollow-bearing trees were recorded on the study area predominantly in the older regrowth ESU, however five of these hollows are considered too small to qualify for biometric criteria (Figure 7 and Appendix 2). The largest tree hollows were observed in Sydney Red Gum which comprised the majority of hollow-bearing trees (85 per cent).

#### **Vegetation condition**

The vegetation in the study area is of variable condition and reflects a long history of clearing, fragmentation and modification. The area has been subject to ongoing impacts associated with use of the site for a walking track along the western boundary adjacent to Forest High School, occupancy of part of the site by squatters, rubbish dumping and uncontrolled fires.

Vegetation in good condition is predominantly found in the eastern portion of sampling area C (part of the former Blinking Light Reserve, east of Bantry Bay Road) and in older regrowth sampling areas A and B west of Bantry Bay Road. Areas in moderate condition generally comprise remnant or regrowth trees characteristic of DFEC with patches of dense native sedge, grass and shrub species cover in the understorey. Vegetation in low or highly disturbed condition is weed dominated around the margins of the site and along tracks. Low condition areas comprise remnant or regrowth trees with predominantly exotic ground cover and understorey, although native species are evident around the base of trees.

DFEC mapped in low condition is considered to still meet the criteria of being an EEC. These areas are considered to maintain important values reflecting the rarity and poor conservation levels of this endangered ecological community. Important values may include:

- maintenance of a native seed bank and regeneration potential;
- provide important fauna habitat including tree hollows;
- provide important winter feed trees for arboreal mammals and birds; or
- provide 'stepping stones' for fauna in an otherwise highly modified landscape.



# LEGEND



Hospital Site

GPS track: *Grevillea caleyi*



DATE 07/12/2012

0 50 100  
1:2,000 Metres

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COORDINATE SYSTEM  
GDA 1994 MGA Zone 56

FIG NO. X

FIGURE TITLE GPS tracking of the targeted search for *Grevillea caleyi*

PROJECT NO. 30011256

PROJECT TITLE Northern Beaches Hospital

CREATED BY D. Gunn



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**FIG NO. 7** **FIGURE TITLE** Hollow bearing trees

**DATE** 04/02/2013  
 0 0.03 0.06  
 1:2,000 Km

**PAGE SIZE** A4  
**COORDINATE SYSTEM** GDA 1994 MGA Zone 56

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**PROJECT NO.** 30011256 **PROJECT TITLE** Northern Beaches Hospital

**CREATED BY** D. Gunn **SOURCES** Vector backdrop © MDS 2012;



Several key threatening processes (KTPs) listed under Schedule 3 of the TSC Act are relevant to the study area and concern exotic species:

- Invasion of native plant communities by exotic perennial grasses (NSW Scientific Committee, 2003a): species listed in the final determination that were recorded within the study area include Pampas Grass (*Cortadeira selloana*), Panic Veldtgrass (*Ehrharta erecta*), Paspalum (*Paspalum urvillei*, *P. quadrifarium*) and Kikuyu (*Pennisetum clandestinum*).
- Invasion and establishment of exotic vines and scramblers (NSW Scientific Committee, 2006b): examples recorded from study area Asparagus Fern (*Asparagus* species), and Honeysuckle (*Lonicera japonica*).
- Invasion, establishment and spread of Lantana (*Lantana camara*) (NSW Scientific Committee, 2006a): Lantana is a common weed in the study area.

### **Site Value variables**

The Site Values recorded for each plot in the spring survey are presented in Table 5; Biometric site scores for these plots are presented in Table 6.

The following is a summary of Site Values of plots recorded in the study area:

- Most of the plots sampled in the older regrowth ESU were within benchmark range for number of species, native overstorey cover and native subshrubs.
- Most of the plots sampled in the older regrowth ESU had high cover values for native grass and native 'other' (non-grass groundcover) but received low benchmark scores because of the low benchmark range (0 – 24 per cent).
- Post-fire regrowth unclassified vegetation (plot A3) was compared against criteria for DFEC as this is the most likely pre-disturbance vegetation type. This plot had low overstorey cover and a low overstorey benchmark score; but this plot also had the highest midstorey score of all the plots (due to dense tea-tree regrowth).
- Plots in both the post-fire regrowth ESU and older regrowth ESU had low values for exotic cover and received the highest benchmark score of three.
- Weed dominated unclassified vegetation (plots A4 and C5) were compared against criteria for DFEC for an example only to demonstrate low scores for exotic benchmark scores. The high benchmark scores for these weedy sites reflects the low benchmark range for native grasses

### **Resilience of vegetation on the study area**

- Older regrowth remnant vegetation on the study area is highly modified as a result of a long history of disturbance including logging and inappropriate fire regimes. However, the high benchmark scores for a number of variables measured on the site indicate the vegetation on the site has sufficient resilience to recover given appropriate management.
- As noted in Smith and Smith (2000), the post-fire regrowth areas mapped as 'highly disturbed' have potential for regeneration given appropriate management. The resilience of these areas is influenced by size, edge effects and fragmentation.
- Weed dominated areas comprise 1.7 ha of the site, particularly around the margins. These areas have low resilience.

**Table 5 Site Value variables sampled in spring**

Plot	Vegetation type	Native species <sup>1</sup>	Native Overstorey % cover	Native Midstorey % cover	Native Grass % cover	Native Subshrub % cover	Native other ground % cover	Length fallen logs (m)	Exotic % cover
A2	DFEC	31	24	10	30	32	38	8	0
A3	DFEC	22	3	17	42	4	54	0	0
A4	DFEC	45	42	7	56	2	42	35	0
B2	DFEC	39	39	9	54	10	36	27	0
B3	DFEC	34	48	7	44	14	42	7	0
C2	DFEC	41	29	12	56	2	42	23	9
C3	DFEC	40	31	11	70	6	22	15	7
A5	Weedy 'DFEC'	24	24	13	22	0	6	0	56
C4	Weedy 'DFEC'	32	38	1	4	0	8	0	91

<sup>1</sup> Number of native species based on species recorded in 20 m x 20 m floristic plots

Plot	Vegetation type	Native Species	Native Overstorey BM <sup>1</sup> score	Native Midstorey BM score	Native Grass BM score	Native Subshrub BM score	Native other ground BM score	Length fallen logs BM score	Exotic BM score
A2	DFEC	2	3	2	2	0	1	1	3
A3	DFEC	2	1	3	1	3	0	0	3
A4	DFEC	3	3	1	0	3	1	3	3
B2	DFEC	2	3	2	0	3	2	2	3
B3	DFEC	2	2	1	1	2	1	1	3
C2	DFEC	3	3	2	0	3	1	2	3
C3	DFEC	3	3	2	0	3	3	2	3
A5	Weedy 'DFEC'	2	3	2	3	3	3	0	1
C4	Weedy 'DFEC'	2	3	0	3	3	3	0	0

<sup>1</sup> BM = BioMetric Benchmark

## 3.7 Fauna survey results

### 3.7.1 Fauna: survey 1 (Winter 2012)

The winter 2012 survey recorded 30 fauna species (Appendix 1). Twenty-four bird species were observed/heard, including the Powerful Owl (*Ninox strenua*) listed as vulnerable under the TSC Act. Six mammal species were captured during the survey period; including two introduced rodent species and the Long-nosed Bandicoot (*Perameles nasuta*). The nearby North Head *P. nasuta* population is listed as endangered under both the TSC Act. However, the individuals on site do not form part of this endangered population. Incidental scat sightings also indicated the presence of the European Rabbit (*Oryctolagus cuniculus*) and an unidentified kangaroo species.

Ten individual Long-nosed Bandicoots were captured during the winter 2012 survey period over 192 trap nights; one in sampling area A, one in sampling area B, and seven in sampling area C over the four night period (Figure 8).

No sex bias was observed, with five male and five female Long-nosed Bandicoots. Of these, none were recaptured. This suggests potentially only a portion of the population on site were sampled. Long-nosed Bandicoots have declined through rapid urbanisation in the Sydney region reducing the amount of dense vegetation necessary for nesting and shelter (NPWS 2000).

### 3.7.2 Fauna: Survey 2 (Spring 2012)

The spring 2012 survey recorded forty-five fauna species (Appendix 1). Thirty-five bird species were observed/heard, including the Powerful Owl which is listed as vulnerable under the TSC Act. Six mammal species were captured during the survey period; including two introduced rodent species and the Long-nosed Bandicoot. The Grey-headed Flying-fox (*Pteropus poliocephalus*), listed as vulnerable under both the TSC Act and the EPBC Act, was observed flying overhead. Incidental scat sightings also indicated the presence of the European Rabbit, and Fox (*Vulpes vulpes*). Two reptile species were recorded: Blue-tongued Lizard (*Tiliqua scincoides*), and Garden Skink (*Lampropholis delicata*). There was no evidence of the Red-crowned Toadlet (*Pseudophryne australis*) being present on site.

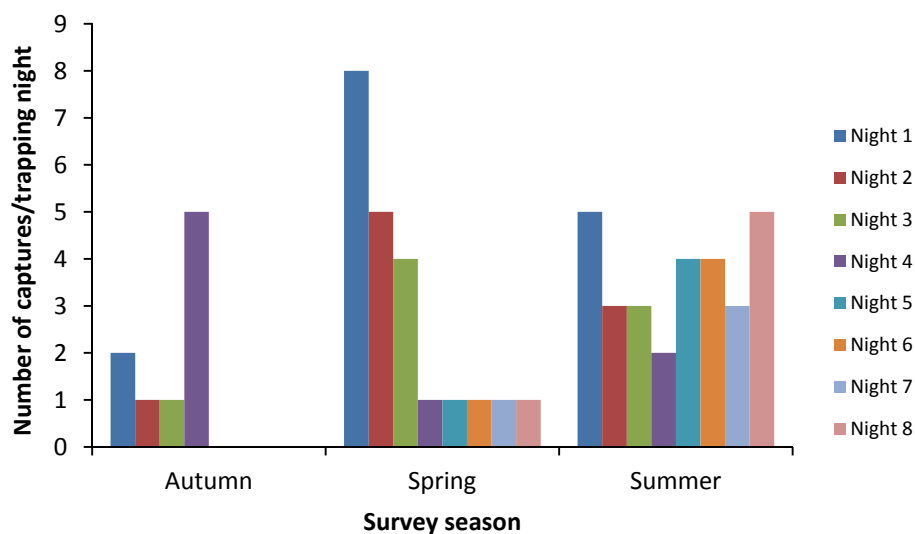
Long-nosed Bandicoots were trapped 39 times across all three sampling areas (A, B and C), with multiple recaptures of some individuals (Figure 8). In total at least thirteen individual adults, two juveniles and eight pouch young were recorded on site. No sex bias was observed in the adults, with six females and seven males. Five of the six females each had either one or two unfurred pouch young.

### 3.7.3 Fauna: Survey 3 (Summer 2013)

The summer 2013 survey recorded 35 fauna species (Appendix 1). Twenty-three bird species were observed/heard, including the Powerful Owl which is listed as vulnerable under the TSC Act. Ten mammal species were captured/sighted during the survey period; including two introduced rodent species, the European Rabbit and the Long-nosed Bandicoot. Of the three bats identified, one, the Grey-headed Flying-fox, is listed as vulnerable under both the TSC Act and the EPBC Act, and was observed flying overhead. Of the two remaining microchiropteran bats, four calls were identified as possibly belonging to either the Chocolate Wattled Bat (*Chalinolobus morio*) or the Little Forest Bat

(*Vespadalus vulturus*). Full details of the microchiropteran bat call analysis are provided in Appendix 8. Incidental scat sightings also indicated the presence of Fox. Two reptile species were recorded: Blue-tongued Lizard, and Garden Skink. There was no evidence of the Red-crowned Toadlet being present on site.

Long-nosed Bandicoots were trapped 29 times across all three sampling areas (A, B and C), with multiple recaptures of some individuals (Figure 8). Trapping was undertaken for four nights during the initial autumn survey, however this was subsequently identified as insufficient to provide reasonable certainty that the species did not occur on the hospital site. In view of this, the survey effort was increased to eight nights for the spring and summer surveys.



**Figure 8 Long-nosed Bandicoot (*Perameles nasuta*) captures per night**

In total at least fourteen individual adults or sub-adults were recorded on site. Five adults previously captured in the spring 2012 survey were not detected in the summer 2013 survey. Eight new adults and seven pouch young were captured during this survey period.

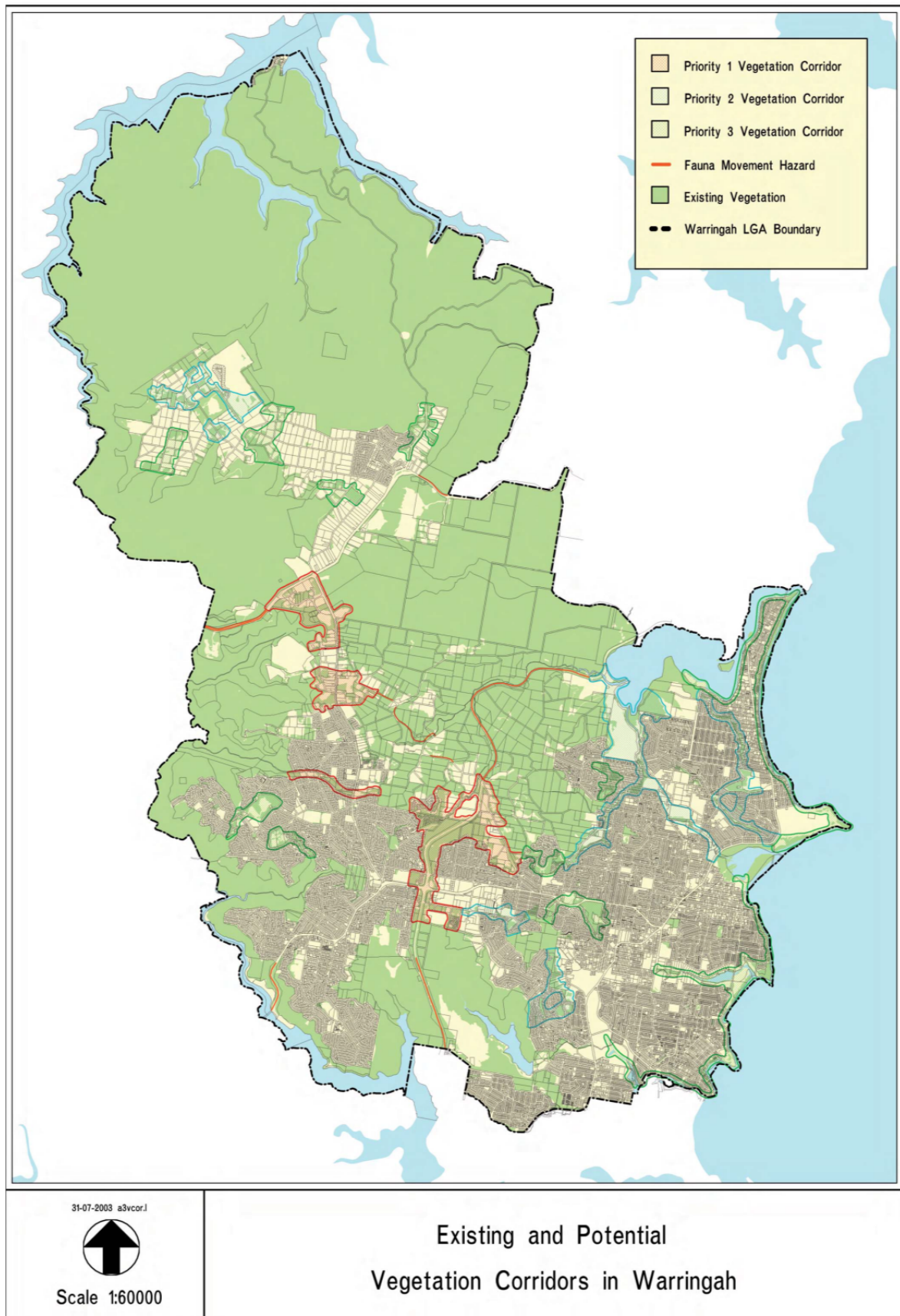
No sex bias was observed in the adult Long-nosed Bandicoots, with six females and eight males trapped. Four of the six females each had either one or two pouch young. Four of the pouch young were large and furred.

### 3.8 Critical habitat

The subject site is not registered as critical habitat under NSW or Commonwealth legislation.

### 3.9 Wildlife connectivity corridors

The hospital site is located within a Priority I Vegetation Corridor (Smith and Smith 2005), being the only area still connecting bushland in Oxford Falls to Manly (Figure 9). Maintaining habitat connectivity is likely to be a high priority for regulatory authorities.



Source: Smith and Smith (2005)

**Figure 9** Vegetation corridors in the Warringah LGA

All Priority I Vegetation Corridors are areas of patchy and disturbed vegetation interrupted by major roads and development. None is a continuous corridor. However, they are important linkages that require recognition, protection and enhancement through bushland rehabilitation or revegetation. Possible means of facilitating fauna movements under or over busy roads should also be investigated. The management issues for the wildlife corridor in the vicinity of the intersection of Wakehurst Parkway and Warringah Road relate less to revegetation to improve the corridor, and more towards facilitating fauna movements and making them less hazardous e.g., by enhancing existing culverts as a route for fauna movements (Smith and Smith 2005).

## 4 Potential impacts

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### 4.1 Loss of vegetation/habitat

The proposed development of the hospital site would result in the clearing of 4.25 ha of native remnant vegetation. Forty-seven mature native trees with hollows and a diversity of shrubs on the site provide habitat for native fauna.

### 4.2 Wildlife connectivity and habitat fragmentation

The study area has been identified as part of an important regional corridor connecting large patches of remnant native vegetation to the north and south (Warringah Council 2008; refer to Section 3.9). Any proposed infrastructure development in this area, including the Northern Beaches Hospital precinct, is likely to result in the removal of native vegetation in this corridor. Fragmentation of native vegetation through this area could reduce its utility as a wildlife corridor, however we note that no scientific studies exist in this location to quantify the ecological significance as a functional corridor. Actual impacts to connectivity would depend on the design and footprint of proposed infrastructure.

### 4.3 Injury and mortality

Bandicoot species are impacted by interactions with vehicles, with a high incident of individuals killed on roads (DEC 2006). Given the close proximity to main roads and the extent of habitat clearing proposed, there is a high likelihood of individuals being injured or killed by cars. Mitigation measures such as fauna underpasses to facilitate movement of ground fauna may reduce incidents of road kill. Southern brown bandicoots have been known to successfully utilise these underpass constructions. However, this strategy must be adopted with caution and contingent on invasive species control, as bandicoot survival has been severely impacted by foxes taking up residence nearby and using the underpasses (Harris *et al* 2010).

### 4.4 Weeds

Eight species of Class 4 noxious weeds listed in the Warringah LGA have been identified on the hospital site as follows:

- Black bamboo (*Phyllostachys nigra*)
- Cape ivy (*Delairea odorata*)
- Lantana (*Lantana camara*)
- Large-leaved and Small-leaved privet (*Ligustrum lucidum* and *L. sinense*)
- Ochna (*Ochna serrulata*)
- Pampas grass (*Cortaderia* sp.)
- Tussock paspalum (*Paspalum quadrifarium*).



## 4.5 Pests and pathogens

The study area is potentially contaminated with *Phytophthora cinnamomi*. Infection of native plants by *P. cinnamomi* is listed as a key threatening process both in NSW and nationally. Evidence of *P. cinnamomi* induced die-back has been identified in several vegetation classes including Sydney coastal dry sclerophyll forests (DECC 2008b). Ongoing loss of understorey species infested with *Phytophthora* can affect threatened and endangered mammal species through the loss of cover, food resources and nesting habitat, including the Southern Brown Bandicoot (*Isoodon obesulus*) and Long-nosed Bandicoot (*Perameles nasuta*) (McDougall & Summerell 2002). Duffys Forest, listed under TSC Act as a threatened ecological community, is also susceptible to this pathogen (DECC 2008b).

Three invasive mammalian species were detected during the surveys: Black Rat (*Rattus rattus*), House Mouse (*Mus musculus*) and European Rabbit (*Oryctolagus cuniculus*).

## 4.6 Impacts from relevant key threatening processes

The following eight KTPs are considered relevant to the proposed hospital development:

- Clearing of native vegetation.
- High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition.
- Invasion and establishment of exotic vines and scramblers.
- Invasion by native plant communities by exotic perennial grasses.
- Invasion, establishment and spread on Lantana (*Lantana camara* L. sens. lat).
- Loss of hollow-bearing trees.
- Predation by the European Red Fox *Vulpes vulpes* (Linnaeus 1758).
- Removal of Dead Wood and Dead Trees.

These are discussed in detail in the following sections.

### **Clearing of native vegetation**

The proposed hospital will result in the loss of about 4.25 ha of DFEC. The condition of this native vegetation is mostly in good to moderate condition.

### **High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition**

Although parts of the site have been unburnt for over 20 years, about 2.3 ha of post-fire regrowth has been subject to uncontrolled frequent fire due to long term occupancy of the site by a homeless man. This area was mapped as 'highly disturbed' by Smith and Smith (2000).

### **Invasion and establishment of exotic vines and scramblers**

The final determination for this KTP states that exotic vines and scramblers may act as transformer species altering the nature of the environment where they become dominant (NSW Scientific Committee 2006b). Exotic vines and scramblers may smother existing vegetation, both in the ground



layer and canopy. This alters the light climate in the invaded community and may suppress regeneration of native species. This KTP is relevant because Asparagus fern (*Asparagus* species) and Honeysuckle (*Lonicera japonica*) occur on the subject site. If not properly managed these exotic species could spread.

#### ***Invasion of native plant communities by exotic perennial grasses***

The final determination for this KTP states that the characteristics of vigorous growth, prolific seed production and effective seed dispersal enable many exotic perennial grasses to compete strongly with, or in some places displace, native vegetation (NSW Scientific Committee, 2003a). Exotic perennial grasses may also change the fuel load in plant communities. The changed structure and fire regimes of the habitat are likely to adversely impact on both native vertebrate and invertebrate fauna.

This KTP is relevant because there are a number of exotic perennial grass species that are listed in the final determination that were recorded within the study area including Pampas grass (*Cortaderia selloana*), Panic veldtgrass (*Ehrharta erecta*), Paspalum (*Paspalum urvillei*, *P. quadrifarium*) and Kikuyu (*Pennisetum clandestinum*). If not properly managed these exotic species could spread.

#### ***Invasion, establishment and spread on Lantana (Lantana camara L. sens. lat)***

The final determination for this KTP states that *L. camara* readily invades disturbed sites and communities. Various types of sclerophyll woodlands, sclerophyll forests, rainforests and dry rainforests are all susceptible to Lantana establishment, although in communities with a naturally dense canopy, Lantana colonisation may be heavily dependent on and limited to disturbance zones, edges, and canopy breaks. There is a strong correlation between Lantana establishment and disturbance with critical factors being disturbance-mediated increases in light and available soil nutrients (NSW Scientific Committee 2006a). Lantana is a common weed in the study area and thus this KTP is also relevant to the project. If not properly managed this exotic species could spread.

#### ***Loss of hollow-bearing trees***

In its final determination for this KTP, the NSW Scientific Committee states that in NSW, terrestrial vertebrate species that are reliant on tree hollows for shelter and nests include at least 46 species of mammal, 81 species of bird, 31 species of reptile and 16 species frog (NSW Scientific Committee 2007). Of these, 40 species are listed as threatened on Schedule 1 and Schedule 2 to the TSC Act. This KTP is relevant because a number of species which are known or potentially could occur in the study area rely on hollow-bearing trees including the Powerful Owl, the Eastern Freetail Bat, the Greater Broad-nosed Bat and the Southern Myotis.

#### ***Predation by the European Red Fox Vulpes vulpes (Linnaeus, 1758)***

In its final determination for this KTP, the NSW Scientific Committee found that predation by the fox is a major threat to the survival of native Australian fauna (NSW Scientific Committee 2004). Fox scats were recorded in the study area, as were small native mammals considered to be vulnerable to predation, hence this KTP is considered to be potentially relevant to the project.

#### ***Removal of dead wood and dead trees***

The NSW Scientific Committee states that the accelerated and ongoing removal of standing dead trees and woody debris on the ground caused by human activity has been recognised as a factor

contributing to loss of biological diversity (NSW Scientific Committee 2003b). This KTP is considered to be relevant because the project would result in the clearing of a 4.25 ha remnant native vegetation and potentially the loss of dead wood and trees.

## 4.7 Cumulative impacts

There will be a cumulative impact of clearing on DFEC, with an estimated 4.48 ha of Duffy Forest to be cleared as a result of the proposed project. Duffys Forest Ecological Community occurs primarily in Warringah and Ku-ring-gai Local Government Areas. It is estimated that only 15% of the original distribution of Duffys Forest Ecological Community remains, all in remnants.

**Table 6 Amount of clearing associated with the project**

Vegetation community	TSC Act (ha)	Subject site <sup>1</sup> (ha)
DFEC (moderate to good condition)	4.25	4.25
DFEC (low to highly disturbed condition)	0.23	0.23
<b>Total</b>	<b>4.48</b>	<b>4.48</b>

<sup>1</sup> Area to be cleared based on ground-truthed vegetation mapping within the study area.

## 5 Recommended mitigation measures

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### 1. Minimise loss of DFEC to the proposed development activities in the study area

- Where possible, retain moderate to good condition DFEC in the study area, such as parts of the area formerly known as Blinking Light Reserve, along the Wakehurst Parkway and Warringah Road.

### 2. Minimise risk of establishment and spread of invasive species due to the proposed development activities in the study area

- Implement controls on the movement of vehicles, and human traffic into Duffys Forest vegetation habitat.
- Require the implementation of a Site Erosion and Sediment Control Plan or Soil Water Management Plan, in accordance with the Blue Book (Landcom 2004).

### 3. Minimise risk of introduction of diseases that may cause decline of threatened biota due to the proposed development activities in the study area

- Implement controls on the movement of vehicles, and human traffic into Duffys Forest vegetation habitat.
- Western Australian Conservation and Land Management guidelines for *Phytophthora cinnamomi* will be adopted to minimise infection to other areas.

### 4. Offset strategy to compensate for loss of EEC and threatened species habitat

- Secure suitable offset areas and biobanking credits to improve and maintain biodiversity values consistent with DFEC proposed to be cleared in the study area.

### 5. Maintenance of habitat corridor and wildlife connectivity

- Ensure the adjacent land directly to the east of the Northern Beaches Hospital site is secured, free from development, and that management plans are in place to maintain its ecological integrity.
- Explore options for increasing wildlife movement across Wakehurst Parkway and Warringah road to connect with corridor e.g. through under or overpasses, rope bridges and gliding poles.

### 6. Minimise loss of DFEC seedbank in topsoil

- DFEC topsoil could be translocated to a cleared recipient site for regeneration. Logs and felled trees retained from the project site can also be relocated to the mitigation site to provide habitat and shelter for fauna.

## **7. Minimise impact on native fauna**

- Mammal (eg bandicoot) translocation through capture and relocating bandicoots to a suitable site.
- Assist in reducing key threatening processes e.g. predation by invasive carnivores, habitat disturbance and interactions with traffic.

## **8. Minimise loss of potential Eastern Pygmy Possum habitat**

- Secure suitable offset areas to be managed for improving and maintaining suitable habitat for Eastern Pygmy Possum consistent with habitat to be cleared in the study area.
- Installation of nest boxes appropriate for utilisation by the Eastern Pygmy Possum in secured offset areas.

## 6 Significance assessments

A summary of the findings of significance assessments for all species listed under the TSC and EPBC Acts which were found to occur, or have potential to occur, in the study area is provided in Table 7 and Table 8 respectively. The comprehensive details of the 7-Part test in accordance with the requirements of Section 5A of the EP&A Act for each threatened species or community are shown in Appendix 5. Details associated with impacts of the proposed project on threatened species and communities of National Environmental Significance (NES) are provided in Appendix 6. The risk matrix used to determine the likelihood of occurrence is shown in Appendix 4.

There is likely to be a significant impact on Duffys Forest Ecological Community. While surveys did not identify the following species, the site contains potential habitat for Netted Bottle Brush, *Epacris purpurascens* var. *purpurascens*, Caley's Grevillea, Angus's Onion Orchid, Hairy Geebung, *Pimelea curviflora* var. *curviflora*, Seaforth Mintbush and Glandular Pink-bell under the TSC Act.

Surveys did not identify the following species, yet the site contains potential habitat of *Epacris purpurascens* var. *purpurascens*, Caley's Grevillea, Angus's Onion Orchid, Hairy Geebung, *Pimelea curviflora* var. *curviflora*, Seaforth Mintbush and Glandular Pink-bell under the EPBC Act.

**Table 7 Summary of the findings of significance assessments under TSC Act**

Threatened species, or communities	Significance assessment question <sup>1</sup>							Likely significant impact?
	a	b	c	d	e	f	g	
<i>Isodon obesulus</i> (Southern Brown Bandicoot)	N	X	X	Y	X	Y	Y	No
<i>Ninox strenua</i> (Powerful Owl)	N	X	X	N	X	N	Y	No
<i>Pteropus poliocephalus</i> (Grey-headed Flying-fox)	N	X	X	N	X	N	Y	No
<i>Callocephalon fimbriatum</i> (Gang-gang Cockatoo)	N	X	X	N	X	N	Y	No
<i>Calyptorhynchus lathami</i> (Glossy Black-Cockatoo)	N	X	X	N	X	N	Y	No
<i>Burhinus grallarius</i> (Bush Stone-curlew)	N	X	X	N	X	N	Y	No
<i>Daphoenositta chrysoptera</i> (Varied Sittella)	N	X	X	N	X	N	Y	No
<i>Glossopsitta pusilla</i> (Little Lorikeet)	N	X	X	N	X	N	Y	No
<i>Petroica boodang</i> (Scarlet Robin)	N	X	X	N	X	N	Y	No
<i>Stagonopleura guttata</i> (Diamond Firetail)	N	X	X	N	X	N	Y	No
<i>Lathamus discolor</i> (Swift Parrot)	N	X	X	N	X	N	Y	No
<i>Hieraaetus morphnoides</i> (Little Eagle)	N	X	X	N	X	N	Y	No
<i>Ninox connivens</i> (Barking Owl)	N	X	X	N	X	N	Y	No
<i>Tyto novaehollandiae</i> (Masked Owl)	N	X	X	N	X	N	Y	No
<i>Tyto tenebricosa</i> (Sooty Owl)	N	X	X	N	X	N	Y	No
<i>Miniopterus schreibersii oceanensis</i> (Eastern Bentwing-bat)	N	X	X	N	X	N	Y	No

Threatened species, or communities	Significance assessment question <sup>1</sup>							Likely significant impact?
	a	b	c	d	e	f	g	
<i>Mormopterus norfolkensis</i> (Eastern Freetail-bat)	N	X	X	N	X	N	Y	No
<i>Myotis macropus</i> (Southern Myotis)	N	X	X	N	X	N	Y	No
<i>Saccolaimus flaviventris</i> (Yellow-bellied Sheath-tail-bat)	N	X	X	N	X	N	Y	No
<i>Scoteanax rueppellii</i> (Greater Broad-nosed Bat)	N	X	X	N	X	N	Y	No
<i>Heleioporus australiacus</i> (Giant Burrowing Frog)	N	X	X	N	X	N	Y	No
<i>Pseudophryne australis</i> (Red-crowned Toadlet)	N	X	X	N	X	N	Y	No
<i>Cercartetus nanus</i> (Eastern Pygmy-possum)	N	X	X	Y	X	N	Y	No
<i>Dasyurus maculatus</i> (Spotted-tailed Quoll)	N	X	X	N	X	N	Y	No
<i>Petaurus australis</i> (Yellow-bellied Glider)	N	X	X	N	X	N	Y	No
<i>Phascolarctos cinereus</i> (Koala)	N	X	X	N	X	N	Y	No
<i>Varanus rosenbergi</i> (Rosenberg's Goanna)	N	X	X	N	X	N	Y	No
Duffys Forest Ecological Community	X	X	Y	Y	X	Y	Y	Yes
<i>Callistemon linearifolius</i> (Netted Bottle Brush)	N	X	X	N	X	N	Y	No
<i>Epacris purpurascens</i> var. <i>purpurascens</i>	N	X	X	N	X	N	Y	No
<i>Grevillea caleyi</i> (Caley's Grevillea)	N	X	X	N	X	N	Y	No
<i>Microtis angusii</i> (Angus's Onion Orchid)	N	X	X	N	X	N	Y	No
<i>Persoonia hirsuta</i> (Hairy Geebung)	N	X	X	N	X	N	Y	No
<i>Pimelea curviflora</i> var. <i>curviflora</i>	N	X	X	N	X	N	Y	No
<i>Prostanthera marifolia</i> (Seaforth Mintbush)	N	X	X	N	X	N	Y	No
<i>Tetradlea glandulosa</i> (Glandular Pink-bell)	N	X	X	N	X	N	Y	No

**Table 8 Summary of the findings of significance assessments under EPBC Act**

Threatened species, or communities	Significance assessment criteria <sup>2,3</sup>									Likely significant impact?
	i	ii	iii	iv	v	vi	vii	viii	ix	
<i>Isodon obesulus</i> (Southern Brown Bandicoot)	Y	N	Y	N	N	N	N	N	N	No
<i>Phascolarctos cinereus</i> (Koala)	N	N	N	N	N	N	N	N	N	No
<i>Pteropus poliocephalus</i> (Grey-headed Flying-fox)	N	N	N	N	N	N	N	N	N	No
<i>Pseudomys novaehollandiae</i> (New Holland Mouse)	N	N	N	N	N	N	N	N	N	No
<i>Heleioporus australiacus</i> (Giant Burrowing Frog)	N	N	N	N	N	N	N	N	N	No
<i>Pimelea curvula</i> var. <i>curvula</i>	X	X	X	X	X	N	X	X	N	No
<i>Tetratheca glandulosa</i> (Glandular Pink-bell)	X	X	X	X	X	N	X	X	N	No
<i>Grevillea caleyi</i> (Caley's Grevillea)	N	N	X	X	X	N	X	X	N	No
<i>Microtis angusii</i> (Angus's Onion Orchid)	N	N	X	X	X	N	X	X	N	No
<i>Persoonia hirsuta</i> (Hairy Geebung)	N	N	X	X	X	N	X	X	N	No
<i>Prostanthera marifolia</i> (Seaforth Mintbush)	N	N	X	X	X	N	X	X	N	No

Notes for Table 7 and Table 8: Y= Yes (negative impact), N= No (no or positive impact), X= not applicable, ?= unknown impact.

I. Significance Assessment Questions as set out in the *Threatened Species Conservation Act 1995/ Environmental Planning and Assessment Act 1979*.

- 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.

2. 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::

- i. lead to a long-term decrease in the size of a population;
- ii. reduce the area of occupancy of the species;
- iii. fragment an existing population into two or more populations;



- iv. adversely affect habitat critical to the survival of a species;
- v. disrupt the breeding cycle of a population;
- vi. modify, destroy, remove isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- vii. result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat.
- viii. Introduce disease that may cause the species to decline;
- ix. Interfere substantially with the recovery of the species.

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

- i. Lead to a long-term decrease in the size of an important population of a species;
- ii. reduce the area of occupancy of an important population\*;
- iii. fragment an existing important population into two or more populations;
- iv. adversely affect habitat critical to the survival of a species;
- v. disrupt the breeding cycle of an important population.
- vi. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
- vii. result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.
- viii. Introduce disease that may cause the species to decline.
- ix. Interfere substantially with the recovery of the species.

\*Important Population as determined by the *Environment Protection and Biodiversity Conservation Act 1999*, is one that for a vulnerable species:

- is likely to be key source populations either for breeding or dispersal
- is likely to be necessary for maintaining genetic diversity
- is at or near the limit of the species range.

## 7 Conclusion

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### 7.1 Overview of key findings

The key findings of this report are as follows.

#### **Flora**

- No threatened flora species have been found on the site.
- Seven regionally and locally significant species were recorded in the study area.
- Comparison of floristic plot data and additional species in areas surrounding the plots provided a good fit for DFEC in the study area using the Duffys Forest Index diagnostic test developed by Smith & Smith 2000.
- 6.5 ha of vegetation on the study area has been provisionally identified as DFEC (2.4 ha of moderate condition vegetation in the older regrowth ESU, 2.35 ha of vegetation in the post-fire regrowth ESU and 1.7 ha of weed dominated vegetation, due to presence of typical canopy species for DFEC).
- Offset requirements will be calculated for 4.25 ha of DFEC in the subject site - excluding 2 ha of remnant vegetation in the area east of Bantry Bay Road (previously part of Blinking Light Reserve).

#### **Fauna**

- Two threatened fauna species have been detected through three seasonal surveys on-site, Powerful Owl (*Ninox strenua*) and Grey-headed Flying-fox (*Pteropus poliocephalus*).
- The Powerful Owl is listed as vulnerable under the TSC Act. The site contains roosting trees suitable for this species. The site has an availability of prey resources, including the common Ringtail Possum (*Pseudocheirus peregrinus*), common Brushtail Possum (*Trichosurus vulpecula*) and Long-nosed Bandicoot (*Perameles nasuta*). The Powerful Owls sighted potentially roost in the adjacent school grounds and use the subject site for foraging. This species has an extensive foraging area and it is highly unlikely the project would have a significant impact.
- Grey-headed Flying-fox (*Pteropus poliocephalus*) is listed as vulnerable under both the TSC Act and EPBC Act. Individuals were sighted flying over the site. However as the site does not contain suitable breeding and roosting resources, and the species has an extensive foraging range, it is unlikely the project would have a significant impact.
- The study area contains good quality habitat, with a combination of dense understorey and open grassy vegetation suitable to sustain a Long-nosed Bandicoot population. Individuals trapped included sub-adults, males and breeding females, suggesting the study area holds a sustainable breeding population. In addition to the individuals that were trapped, multiple conical diggings were observed in open, grassy areas. The presence suggests foraging is occurring throughout several sections of the study area (Stodart 1966). Mitigation strategies have been suggested to minimise impact on native fauna present on site.

- Potential foraging habitat available for threatened fauna species including the Southern Brown Bandicoot (*Isodon obesulus*) that is listed as endangered under both the TSC Act and the EPBC Act. and the Eastern Pygmy Possum (*Cercartetus nanus*) that is listed as vulnerable under the TSC Act. Field surveys of the study area failed to detect these species; however, intensive trapping programs previously undertaken in New South Wales have produced low rates of detection. Therefore to offset any potential impacts, mitigation measures have been proposed to enhance the surrounding habitat to provide suitable habitat nearby.

## 7.2 Implications for offset strategies

The spring survey was undertaken in accordance with the NSW BioBanking Methodology. The results of additional plots surveyed in spring and an independent expert assessment of vegetation on the site helped to establish that Duffys Forest EEC occurs on the site. Thus, the potential offset requirements for the proposed Northern Beaches Hospital development on the site will be determined by the need to offset approximately 4.25 ha of DFEC in good to moderate condition.

Threats to bandicoots in NSW include predation by invasive carnivores, habitat disturbance and interactions with traffic. Patchy distribution and potential localised population extinction also threatened the long-term viability of this species (DEC 2006). Given the extent of vegetation clearing required for the project, the only appropriate strategy is a translocation program to remove the entire population to an alternate site. Most management strategies for this species surround the retention and regeneration of key habitat with dense understorey. As that is not possible in this case, translocation is a last, but necessary, resort (DSEWPac 2011).

The project is located in an area where several major roads intersect. Existing remnant vegetation adjacent to the study area is not currently sufficient to provide enough suitable habitat and coverage to act as wildlife corridors. The improvement of existing corridors and creation of additional corridors are necessary to facilitate wildlife movement out of the study area and across the landscape. Additional mitigation strategies are required for movement across roads such as wildlife crossing structures, including underpasses for ground-dwelling fauna and rope bridges for arboreal fauna such as the common ringtail possum and common brushtail possum.

Soil translocation of remnant DFEC is a potential mitigation strategy that has been adopted previously by Roads and Maritime Services (RMS), Manly Council and Warringah Council. This technique has been successfully trialled during construction of a development site in Belrose in 2009 (Warringah Council) and road construction in Seaforth. To mitigate the loss of native vegetation at the subject site, top soil could be translocated to a cleared recipient site for regeneration. Logs and felled trees retained from the project site can also be relocated to the mitigation site to provide habitat and shelter.

This strategy is financially beneficial, saving disposal fees for clean top soil, and environmentally beneficial to seed bank regeneration. This strategy is contingent on care being taken with the top soil at all times to retain viable soil seed bank and specific conditions as to how the vegetation is moved (Toolijooa Environmental Restoration 2006 and GIS Environmental Consultants 2007).

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# Appendix I

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## Species recorded within the study area and adjacent areas



**Table 9 Flora species recorded during survey periods 1 to 3**

Family	Species	Common name	Survey 1	Survey 2	Additional species (James 2013)	Aquatic Drive Offset site
Fabaceae	<i>Acacia fimbriata</i>	Fringed Wattle		*		
Fabaceae	<i>Acacia floribunda</i>	White Sally Wattle		*		
Fabaceae	<i>Acacia irrorata</i>	Green Wattle	*	*		*
Fabaceae	<i>Acacia linifolia</i>	White Wattle	*			
Fabaceae	<i>Acacia longissima</i>	Long-leaf Wattle	*	*		*
Fabaceae	<i>Acacia myrtifolia</i>	Red-stemmed Wattle	*	*		*
Fabaceae	<i>Acacia parramattensis</i>	Parramatta wattle			*	
Fabaceae	<i>Acacia saligna</i>	Golden Wreath Wattle				*
Fabaceae	<i>Acacia ulicifolia</i>	Prickly Moses		*		
Pteridaceae	<i>Adiantum aethiopicum</i>	Common Maidenhair		*		
Asteraceae	<i>Ageratina adenophora</i> <sup>1</sup>	Crofton Weed	*	*		
Casuarinaceae	<i>Allocasuarina distyla</i>	Scrub She-oak		*		
Casuarinaceae	<i>Allocasuarina littoralis</i>	Black She-oak	*	*		*
Poaceae	<i>Andropogon virginicus</i>	Whisky Grass	*	*		*
Myrtaceae	<i>Angophora costata</i>	Sydney Red Gum	*	*		*
Asparagaceae	<i>Asparagus aethiopicus</i> <sup>1</sup>	Asparagus 'Fern'		*		
Asparagaceae	<i>Asparagus asparagoides</i>	Bridal Creeper				*
Poaceae	<i>Austrostipa pubescens</i>	Spear Grass		*		
Poaceae	<i>Axonopus fissifolius</i> <sup>1</sup>	Narrow-leafed Carpet Grass		*		*

Family	Species	Common name	Survey 1	Survey 2	Additional species (James 2013)	Aquatic Drive Offset site
Proteaceae	<i>Banksia serrata</i>	Old-man Banksia	*	*		*
Proteaceae	<i>Banksia spinulosa</i>	Hairpin Banksia	*			
Asteraceae	<i>Bidens pilosa</i> <sup>1</sup>	Cobblers Pegs		*		*
Blechnaceae	<i>Blechnum cartilagineum</i>	Gristle Fern		*		
Rutaceae	<i>Boronia pinnata</i>	Boronia			*	
Fabaceae	<i>Bossiaea obcordata</i>	Spiny Bossiaea		*		
Poaceae	<i>Briza maxima</i> <sup>1</sup>	Quaking Grass		*		
Poaceae	<i>Bromus catharticus</i> <sup>1</sup>	Prairie Grass		*		
Colchicaceae	<i>Burchardia umbellata</i>	Milkmaids		*		
Pittosporaceae	<i>Bursaria spinosa</i>	Blackthorn		*		
Cunoniaceae	<i>Callicoma serratifolia</i>	Black Wattle		*		
Myrtaceae	<i>Callistemon linearis</i>	Narrow-leaved Bottlebrush	*	*		*
Cupressaceae	<i>Callitris rhomboidea</i>	Port Jackson Pine		*		
Lauraceae	<i>Cassytha glabella</i>	Slender Devil's Twine		*		
Cyperaceae	<i>Caustisflexuosa</i>	Curly Wig	*	*		
Apiaceae	<i>Centella asiatica</i>	Indian Pennywort		*		
Cunoniaceae	<i>Ceratopetalum apetalum</i>	Coachwood		*		
Cunoniaceae	<i>Ceratopetalum gummiferum</i>	Christmas Bush		*		
Santalaceae	<i>Choretrum candollei</i>	White Sour Bush		*		
Asteraceae	<i>Cirsium vulgare</i> <sup>1</sup>	Spear Thistle		*		

Family	Species	Common name	Survey 1	Survey 2	Additional species (James 2013)	Aquatic Drive Offset site
Ranunculaceae	<i>Clematis aristata</i>	Headache Vine	*	*		
Polygalaceae	<i>Comesperma ericinum</i>	Pyramid Flower			*	
Convolvulaceae	<i>Convolvulus erubescens</i>	Pink Bindweed		*		
Asteraceae	<i>Conyza bonariensis</i> <sup>1</sup>	Flax-leaved Feabane		*		
Poaceae	<i>Cortaderia selloana</i> <sup>1</sup>	Pampas Grass				*
Myrtaceae	<i>Corymbia gummifera</i>	Red Bloodwood	*	*		
Malaceae	<i>Cotoneaster glaucophyllus</i>	Cotoneaster *	*	*		
Cyperaceae	<i>Cyathochaeta diandra</i>	Cyathochaeta	*			*
Poaceae	<i>Cynodon dactylon</i>	Couch Grass		*		
Cyperaceae	<i>Cyperus gracilis</i>	Slender Sedge		*		
Asteraceae	<i>Delairea odorata</i> <sup>1</sup>	Cape Ivy		*		
Poaceae	<i>Deyeuxia decipiens</i>	Devious Bent-grass		*		
Phormiaceae	<i>Dianella caerulea</i>	Blue Flax-lily	*	*		*
Poaceae	<i>Dichelachne micrantha</i>	Shorthair Plumegrass			*	
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed		*		
Fabaceae	<i>Dillwynia retorta</i>	Dillwynnia	*			*
Sapindaceae	<i>Dodonaea triquetra</i>	Large-leaf Hop-bush	*	*		
Poaceae	<i>Ehrharta erecta</i> <sup>1</sup>	Panic Veldtgrass		*		
Elaeocarpaceae	<i>Elaeocarpus reticulatus</i>	Blueberry Ash		*		
Poaceae	<i>Entolasia marginata</i>	Bordered Panic		*		

Family	Species	Common name	Survey 1	Survey 2	Additional species (James 2013)	Aquatic Drive Offset site
Poaceae	<i>Entolasia stricta</i>	Wiry Panic	*	*		
Ericaceae	<i>Epacris pulchella</i>	Wallum Heath	*	*		
Myrtaceae	<i>Eucalyptus capitellata</i>	Brown Stringybark	*	*		
Myrtaceae	<i>Eucalyptus globoidea</i>	White Stringybark			*	
Myrtaceae	<i>Eucalyptus haemastoma</i>	Broad-leaved Scribbly Gum			*	
Myrtaceae	<i>Eucalyptus resinifera</i>	Red Mahogany	*	*		
Myrtaceae	<i>Eucalyptus robusta</i>	Swamp Mahogany	*	*		
Myrtaceae	<i>Eucalyptus saligna</i>	Sydney Blue Gum	*	*		
Myrtaceae	<i>Eucalyptus sieberi</i>	Silvertop Ash	*			
Myrtaceae	<i>Eucalyptus umbra</i>	Broad-leaved White Mahogany	*	*		
Cyperaceae	<i>Gahnia erythrocarpa</i>	Saw-segde	*	*		
Cyperaceae	<i>Gahnia radula</i>	Saw-segde	*	*		
Gleicheniaceae	<i>Gleichenia dicarpa</i>	Pouched Coral Fern	*	*		
Euphorbiaceae	<i>Glochidion ferdinandi</i>	Cheese Tree		*		
Fabaceae	<i>Glycine microphylla</i>	Small-leaf Glycine		*		
Haloragaceae	<i>Gonocarpus teucrioides</i>	Raspwort		*		
Goodeniaceae	<i>Goodenia heterophylla</i>	Forest Goodenia		*		
Proteaceae	<i>Grevillea linearifolia</i>	Linear-leaf Grevillea		*		*
Proteaceae	<i>Hakea dactyloides</i>	Broad-leaved Hakea	*	*		
Proteaceae	<i>Hakea sericea</i>	Needlebush	*			*

Family	Species	Common name	Survey 1	Survey 2	Additional species (James 2013)	Aquatic Drive Offset site
Dilleniaceae	<i>Hibbertia empetrifolia</i>	Guinea Flower		*		
Euphorbiaceae	<i>Homalanthus populifolius</i>	Bleeding Heart		*		
Asteraceae	<i>Hypochaeris radicata</i> <sup>1</sup>	Catsear		*		
Dennstaedtiaceae	<i>Hypolepis muelleri</i>	Harsh Ground Fern		*		
Poaceae	<i>Imperata cylindrica</i>	Blady Grass	*	*		
Verbenaceae	<i>Lantana camara</i>	Lantana *	*	*		*
Sterculiaceae	<i>Lasiopetalum ferrugineum</i>	Rusty Velvet-bush	*	*		
Cyperaceae	<i>Lepidosperma filiforme</i>	Sword-sedge		*		
Cyperaceae	<i>Lepidosperma laterale</i>	Sword Sedge	*	*		
Myrtaceae	<i>Leptospermum polygalifolium</i>	Tantoon	*	*		*
Myrtaceae	<i>Leptospermum trinervium</i>	Flaky-barked Tea-tree		*		
Ericaceae	<i>Leucopogon lanceolatus</i>	Beard-heath			*	
Oleaceae	<i>Ligustrum lucidum</i> <sup>1</sup>	Large Leaved Privet *		*		
Oleaceae	<i>Ligustrum sinense</i> <sup>1</sup>	Small Leaved Privet *	*	*		*
Lindsaeaceae	<i>Lindsaea linearis</i>	Screw Fern	*	*		*
Lindsaeaceae	<i>Lindsaea microphylla</i>	Lacy Wedge Fern		*		
Lomandraceae	<i>Lomandra gracilis</i>	Mat-rush		*		
Lomandraceae	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	*	*		*
Lomandraceae	<i>Lomandra multiflora</i>	Many-flowered Mat-rush		*		
Lomandraceae	<i>Lomandra obliqua</i>	Mat-rush	*	*		*



Family	Species	Common name	Survey 1	Survey 2	Additional species (James 2013)	Aquatic Drive Offset site
Proteaceae	<i>Lomatia silaifolia</i>	Crinkle Bush	*	*		
Caprifoliaceae	<i>Lonicera japonica</i>	Japanese Honeysuckle *	*	*		
Myrtaceae	<i>Lophostemon confertus</i>	Brush Box	*			
Myrtaceae	<i>Melaleuca hypericifolia</i>	Hillock Bush		*		
Myrtaceae	<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark		*		
Picrodendraceae	<i>Micrantheum ericoides</i>	Heath	*	*		
Poaceae	<i>Microlaena stipoides</i>	Weeping Rice Grass		*		
Fabaceae	<i>Mirbelia rubiifolia</i>	Heathy Mirbelia			*	
Lomariopsidaceae	<i>Nephrolepis cordifolia</i>	Fishbone Fern				*
Oleaceae	<i>Notelaea longifolia</i>	Native Olive		*		
Ochnaceae	<i>Ochna serrulata</i> <sup>1</sup>	Mickey Mouse Plant		*		
Asteraceae	<i>Olearia microphylla</i>	Daisy Bush		*		
Rubiaceae	<i>Opercularia aspera</i>	Coarse Stinkweed	*			
Poaceae	<i>Oplismenus aemulus</i>	Australian Basket Grass		*		
Poaceae	<i>Oplismenus imbecillis</i>	Creeping Beard Grass		*		
Oxalidaceae	<i>Oxalis exilis</i>	Oxalis		*		
Asteraceae	<i>Ozothamnus diosmifolius</i>	White Dogwood		*		
Poaceae	<i>Paspalum quadrifarium</i>	Tussock Paspalum *	*	*		
Poaceae	<i>Paspalum urvillei</i>	Vasey Grass *	*			
Passifloraceae	<i>Passiflora edulis</i> <sup>1</sup>	Passionfruit		*		

Family	Species	Common name	Survey 1	Survey 2	Additional species (James 2013)	Aquatic Drive Offset site
Iridaceae	<i>Patersonia sericea</i>	Silky Purple-Flag	*			*
Poaceae	<i>Pennisetum clandestinum</i> <sup>1</sup>	Kikuyu		*		*
Proteaceae	<i>Persoonia lanceolata</i>	Lance Leaf Geebung			*	
Proteaceae	<i>Persoonia laurina</i>	Laurel Geebung			*	
Proteaceae	<i>Persoonia levis</i>	Broad-leaved Geebung	*	*		
Proteaceae	<i>Persoonia linearis</i>	Geebung		*		
Proteaceae	<i>Persoonia pinifolia</i>	Pine-leaved Geebung	*	*		
Proteaceae	<i>Petrophile pulchella</i>	Conesticks				*
Phyllanthaceae	<i>Phyllanthus hirtellus</i>	Thyme Spurge	*	*		
Poaceae	<i>Phyllostachys nigra</i> <sup>1</sup>	Black Bamboo	*			
Fabaceae	<i>Phyllota phylloides</i>	Heath Phyllota	*	*		
Pinaceae	<i>Pinus patula</i>	Patula Pine *	*			
Pittosporaceae	<i>Pittosporum undulatum</i>	Sweet Pittosporum	*	*		*
Plantaginaceae	<i>Plantago lanceolata</i> <sup>1</sup>	Lamb's Tongue		*		*
Lamiaceae	<i>Plectranthus parviflorus</i>	Cockspur Flower		*		
Poaceae	<i>Poa affinis</i>	Poa			*	
Polygalaceae	<i>Polygala myrtifolia</i> <sup>1</sup>	Polygala	*	*		*
Araliaceae	<i>Polyscias sambucifolia</i>	Elderberry Panax		*		
Lobeliaceae	<i>Pratia purpurascens</i>	Whiteroot	*	*		*
Lamiaceae	<i>Prostanthera denticulata</i>	Rough Mint-bush	*	*		*

Family	Species	Common name	Survey 1	Survey 2	Additional species (James 2013)	Aquatic Drive Offset site
Dennstaedtiaceae	<i>Pteridium esculentum</i>	Bracken	*	*		*
Fabaceae	<i>Pultenaea daphnoides</i>	Large-leaf Bush-pea		*		
Fabaceae	<i>Pultenaea hispidula</i>	Bush-pea		*		
Fabaceae	<i>Pultenaea scabra</i>	Rough Bush-pea		*		
Fabaceae	<i>Pultenaea tuberculata</i>	Wreath Bush-pea			*	
Fabaceae	<i>Pultenaea villosa</i>	Hairy Bush-pea		*		
Rosaceae	<i>Rubus fruticosus</i> <sup>1</sup>	Blackberry		*		
Polygonaceae	<i>Rumex brownie</i>	Swamp Dock		*		
Poaceae	<i>Rytidosperma tenuius</i>	Wallaby Grass		*		
Cyperaceae	<i>Schoenus imberbis</i>	Beardless Bog-rush		*		
Cyperaceae	<i>Schoenus melanostachys</i>	Black Bog-rush		*		
Asteraceae	<i>Senecio madagascariensis</i> <sup>1</sup>	Fireweed				*
Fabaceae	<i>Senna pendula</i> <sup>1</sup>	Senna		*		
Malvaceae	<i>Sida rhombifolia</i> <sup>1</sup>	Paddy's Lucerne		*		
Smilacaceae	<i>Smilax glyciphylla</i>	Sweet Sarsaparilla		*		
Solanaceae	<i>Solanum nigrum</i> <sup>1</sup>	Blackberry Nightshade		*		
Poaceae	<i>Stenotaphrum secundatum</i> <sup>1</sup>	Buffalo Grass		*		
Poaceae	<i>Tetrarrhena juncea</i>	Wiry Ricegrass		*		
Poaceae	<i>Themeda australis</i>	Kangaroo Grass			*	*
Commelinaceae	<i>Tradescantia fluminensis</i> <sup>1</sup>	Wandering Trad		*		

Family	Species	Common name	Survey 1	Survey 2	Additional species (James 2013)	Aquatic Drive Offset site
Verbenaceae	<i>Verbena hispida</i>	Rough Verbena *	*			*
Scrophulariaceae	<i>Veronica plebeia</i>	Trailing Speedwell		*		
Fabaceae	<i>Viminaria juncea</i>	Golden spray		*		
Violaceae	<i>Viola hederacea</i>	Ivy-leaved Violet			*	
Xanthorrhoeaceae	<i>Xanthorrhoea media</i>	Grass Tree		*		
Xanthorrhoeaceae	<i>Xanthosia pilosa</i>	Woolly Xanthosia		*		
Apiaceae	<i>Xanthosia tridentata</i>	Rock Xanthosia	*	*		*
Proteaceae	<i>Xylomelum pyrifforme</i>	Woody Pear			*	

<sup>1</sup> Denotes introduced species

**Table 10 Fauna species recorded during survey periods (June 2012, October 2012 and February 2013)**

Class	Species	Common name	Survey 1	Survey 2	Survey 3	TSC Act	EPBC Act
Aves	<i>Acanthiza pusilla</i>	Brown Thornbill		*	*	No	No
Aves	<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill	*	*	*	No	No
Aves	<i>Acridotheres tristis</i> <sup>1</sup>	Indian Myna	*	*	*	No	No
Aves	<i>Alectura lathami</i>	Australian Brush-turkey		*		No	No
Aves	<i>Anthochaera carunculata</i>	Red Wattlebird		*		No	No

Class	Species	Common name	Survey 1	Survey 2	Survey 3	TSC Act	EPBC Act
Aves	<i>Anthochaera chrysoptera</i>	Little Wattlebird	*	*		No	No
Aves	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	*	*	*	No	No
Aves	<i>Calyptorhynchus funereus</i>	Yellow-tailed Black Cockatoo	*	*		No	No
Aves	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo Shrike	*		*	No	No
Aves	<i>Corvus coronoides</i>	Australian Raven	*	*	*	No	No
Aves	<i>Corvus mellori</i>	Little Raven		*		No	No
Aves	<i>Dacelo novaeguineae</i>	Laughing Kookaburra	*	*	*	No	No
Aves	<i>Eopsaltria australis</i>	Eastern Yellow Robin	*	*	*	No	No
Aves	<i>Eudynamys scolopacea</i>	Common Koel		*		No	No
Aves	<i>Eurystomus orientalis</i>	Dollarbird		*		No	No
Aves	<i>Grallina cyanoleuca</i>	Magpie-lark		*	*	No	No
Aves	<i>Gymnorhina tibicen</i>	Australian Magpie	*		*	No	No
Aves	<i>Hirundo neoxena</i>	Welcome Swallow			*	No	No
Aves	<i>Lichenostomus fuscus</i>	Fuscous Honeyeater	*	*		No	No
Aves	<i>Malurus cyaneus</i>	Superb Fairy-wren	*	*	*	No	No
Aves	<i>Manorina melanocephala</i>	Noisy Miner	*	*	*	No	No
Aves	<i>Neochmia temporalis</i>	Red-browed Finch	*		*	No	No
Aves	<i>Ninox novaeseelandiae</i>	Southern Boobook	*		*	No	No
Aves	<i>Ninox strenua</i>	Powerful Owl	*	*	*	Yes	No
Aves	<i>Pachycephala rufiventris</i>	Rufous Whistler			*	No	No
Aves	<i>Pardalotus punctatus</i>	Spotted Pardalote		*		No	No

Class	Species	Common name	Survey 1	Survey 2	Survey 3	TSC Act	EPBC Act
Aves	<i>Passer domesticus</i> <sup>1</sup>	House Sparrow	*			No	No
Aves	<i>Phylidonyris nigra</i>	White-cheeked Honeyeater		*		No	No
Aves	<i>Psophodes olivaceus</i>	Eastern Whipbird	*	*	*	No	No
Aves	<i>Rhipidura albiscapa</i>	Grey Fantail	*	*	*	No	No
Aves	<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo		*		No	No
Aves	<i>Sericornis frontalis</i>	White Browed Scrubwren	*	*	*	No	No
Aves	<i>Strepera versicolour</i>	Pied Currawong	*	*	*	No	No
Aves	<i>Threskiornis molucca</i>	Australian White Ibis		*		No	No
Aves	<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	*	*	*	No	No
Aves	<i>Zoothera sp.</i>	Thrush	*			No	No
Aves	<i>Zosterops lateralis</i>	Silvereye	*	*	*	No	No
Mammalia	<i>Antechinus stuartii</i>	Brown Antechinus	*	*	*	No	No
Mammalia	<i>Chalinolobus morio</i>	Chocolate Wattled Bat			*	No	No
Mammalia	<i>Mus musculus</i> <sup>1</sup>	Mouse	*	*	*	No	No
Mammalia	<i>Oryctolagus cuniculus</i> <sup>1</sup>	European Rabbit	*	*	*	No	No
Mammalia	<i>Perameles nasuta</i>	Long-nosed Bandicoot	*	*	*	No	No
Mammalia	<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum	*	*	*	No	No
Mammalia	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox		*	*	Yes	Yes
Mammalia	<i>Rattus rattus</i> <sup>1</sup>	Black Rat	*	*	*	No	No
Mammalia	<i>Tadarida australis</i>	White-striped Freetail Bat		*		No	No
Mammalia	<i>Trichosurus vulpecula</i>	Common Brushtail Possum	*	*	*	No	No

Class	Species	Common name	Survey 1	Survey 2	Survey 3	TSC Act	EPBC Act
Mammalia	<i>Vespadelus darlingtoni</i>	Large Forest Bat		*		No	No
Mammalia	<i>Vespadelus vulturinus</i>	Little Forest Bat			*	No	No
Reptile	<i>Tiliqua scincoides</i>	Blue Tongue Lizard		*	*	No	No
Reptile	<i>Lampropholis delicata</i>	Garden Skink		*	*	No	No

<sup>1</sup> Denotes introduced species



# Appendix 2

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## Vegetation descriptions and field survey results



**Table 11 Candidate vegetation types**

EEC	SMCMA Vegetation community type	BioMetric Type	Regional Class	Statewide Class
Yes	Sydney Ironstone Bloodwood-Silvertop Ash Forest (S_DFS14)	A component of Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin (ME039).	Component of Sydney Shale-Ironstone Cap Forest	Sydney Coastal Dry Sclerophyll Forests
No (Parts previously included in DFEC)	Coastal Shale-Sandstone Forest (S_WSF06)	A component of Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin (ME039).	Component of Sydney Shale-Ironstone Cap Forest	Northern Hinterland Wet Sclerophyll Forests
No	Coastal Enriched Sandstone Sheltered Forest (S_DSF04)	A component of Smooth - barked Apple - Red Bloodwood - Sydney Peppermint heathy open forest on slopes of dry sandstone gullies of western and southern Sydney, Sydney Basin (ME039).	Component of Hinterland Sandstone Gully Forest	Sydney Coastal Dry Sclerophyll Forest
No	Hornsby Enriched Sandstone Exposed Woodland (S_DSF10)	Not described.	Component of Coastal Sandstone Ridgetop Woodland	Sydney Coastal Dry Sclerophyll Forest
No	Coastal Sandstone Apple-Peppermint Gully Forest (S_DSF09)	Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin (ME012).	Coastal Sandstone Gully Forest	Sydney Coastal Dry Sclerophyll Forest
No	Hornsby Sandstone Exposed Bloodwood Woodland (S_DSF11)	Not described.	Sydney Shale-Ironstone Cap Forest	Sydney Coastal Dry Sclerophyll Forests

### **Sydney Ironstone Bloodwood-Silvertop Ash Forest**

Known as Duffys Forest in some vegetation classifications (Benson & Howell 1994a; Smith & Smith 2000) this community forms a component of the shrubby forests and woodlands of coastal Sydney sandstone environments. The exception with this assemblage is its close association with rust coloured ironstone mantles layered above sandstone ridgelines in combination with mean annual rainfall above 1100 mm. It features a low to moderately tall eucalypt cover of red bloodwood (*Corymbia gummifera*), silvertop ash (*Eucalyptus sieberi*) and stringybark (*Eucalyptus capitellata* / *Eucalyptus oblonga*) on flat to gently sloping terrain. Broad-leaved scribbly gums (*Eucalyptus haemastoma*) and smooth-barked apple (*Angophora costata*) are not uncommon at sites although they rarely dominate. The shrub layer is particularly diverse amongst the *Proteaceae* family. This means there are often multiple species of banksias, hakea, persoonia and grevillea present at a site. A moderate cover of grasses and forbs are found on the forest floor. The range in elevation parameters for the community varies between 100 and 300 metres above sea level. The thickness of the ironstone mantle may vary considerably across different sites and in some instances maybe completely eroded. Invariably however almost all sites appear to have minor or absent rock outcropping.

The extensive though fragmented distribution of the community across the lateritic soils of the Duffys Forest and northern beaches hinterland gave rise to the use of the suburb name in the classification nomenclature. However it is clear that a large area of lateritic ironstone is also present between Bulli and Sutherland in southern Sydney where environmental conditions mirror those found to the north. Samples confirm that vegetation assemblages found here form a combined vegetation community formerly thought restricted to the northern hinterland.

### **Coastal Shale-sandstone Forest**

Coastal Shale-sandstone Forest is often a tall open eucalypt forest with a sparse layer of dry sclerophyllous shrubs and a grassy ground cover. It occurs on clay influenced soils associated with residual shale or lateritic capping, shale bands in the sandstone bedrock or down slope shale wash on exposed sandstone slopes. The most consistently occurring eucalypts are tall red bloodwood (*Corymbia gummifera*) and smooth-barked apple (*Angophora costata*) though it is the local abundance of blackbutt (*Eucalyptus pilularis*), turpentine (*Syncarpia glomulifera*) and mahogany (*Eucalyptus resinifera*, *E. umbra*) that make the forest distinctive from the surrounding sandstone woodlands. A tall sparse layer of casuarinas (*Allocasuarina littoralis*) is found above an open layer of dry shrubs including banksias, wattles, hakeas and geebung. A diverse combination of grasses, rushes and herbs provide a continuous ground cover. In some areas the forest may form a low open woodland comprising smooth-barked apple, brown stringybark (*Eucalyptus capitellata*), scribbly gum (*Eucalyptus racemosa*) amongst other species. A thin layer of clay soil is sufficient to retain the grassy ground covers that help to distinguish the community. Some stands of this forest have previously been recognised as a variant of Duffys Forest (Smith and Smith 2000), an Endangered Ecological Community under the NSW TSC Act. Coastal Shale-sandstone Forest is found in areas that receive more than 900 mm per annum and are restricted to elevations between 2 and 372 metres above sea level.

### **Coastal Enriched Sandstone Sheltered Forest**

This community is perhaps one of the most commonly encountered forests found within the urban core of the SMCMA area. It occurs on soils derived from sandstones in the coastal zone north of the Hacking River area. It occupies a range of topographic positions although steep sheltered slopes are most common. It is a tall open eucalypt forest with an understorey of dry sclerophyll shrubs with ferns and forbs amongst the ground cover. The commonly recorded eucalypts are smooth-barked apple (*Angophora costata*), red bloodwood (*Corymbia gummifera*) and Sydney peppermint (*Eucalyptus piperita*). A variety of other species may co-occur including localised patches of blackbutt (*Eucalyptus pilularis*) on some harbour foreshores and broad-leaved white mahogany (*Eucalyptus umbra*) in the Warringah area. A sparse layer of small trees such as *Allocasuarina littoralis* and old-man banksia (*Banksia serrata*) is common above a variety of wattles, tea-trees, gee bungs and grass trees. In long unburnt areas sweet pittosporum (*Pittosporum undulatum*) may be prevalent. It is widespread on the Hornsby Plateau in areas that receive greater than 1000 mm of mean annual rainfall and at elevations less than 200 metres above sea level. It extends north of the SMCMA into the hinterland of the central coast and west to the footslopes of the northern Blue Mountains.

One of the distinguishing features of the community is that it appears to persist in areas that have subtle clay enrichment to the sandstone soils. Typically sites are located downslope from large residual shale caps or on exposed Narrabeen sandstone or thin clay bands on coastal sandstone ridgetops. The clay influence is not immediately discernable at sites but does appear expressed in the plant assemblage resulting in more prominent mesic species and a less abundant heath species than sheltered forests found on rockier and more siliceous sandstones.

### **Coastal Sandstone Apple-Peppermint Gully Forest**

Coastal Sandstone Apple-Peppermint Gully Forest is widely distributed along the eastern extent of Sydney sandstone plateau. It occupies sheltered aspects on infertile Hawkesbury sandstone geology in areas that receive in excess of 1000 mm of mean annual rainfall. Sydney peppermint (*Eucalyptus piperita*) and smooth-barked apple (*Angophora costata*) form a moderately tall open forest. These are rocky environments and the understorey is a diverse mix of heath and shrub species such as banksias, tea-trees and wattles. The taller NSW Christmas bush (*Ceratopetalum gummiferum*) is also commonly encountered and is conspicuous in early summer when it flowers profusely. South of Sydney it is the spectacular large red flower and luxuriant green leaves of the Gynea lily (*Doryanthes excelsa*) that immediately catches the eye. They are found scattered across the forest floor amongst patches of ferns, grasses, sedges and rock outcrops. The Gynea lily however is uncommonly recorded in northern Sydney.

### **Hornsby Enriched Sandstone Exposed Woodland**

This community is perhaps one of the most commonly encountered forests found within the urban core of the SMCMA area. It occurs on soils derived from sandstones in the coastal zone north of the Hacking River area. It occupies a range of topographic positions although steep sheltered slopes are most common. It is a tall open eucalypt forest with an understorey of dry sclerophyll shrubs with ferns and forbs amongst the ground cover. The commonly recorded eucalypts are smooth-barked apple (*Angophora costata*), red bloodwood (*Corymbia gummifera*) and Sydney peppermint (*Eucalyptus piperita*). A variety of other species may co-occur including localised patches of blackbutt (*Eucalyptus*

*pilularis*) on some harbour foreshores and broad-leaved white mahogany (*Eucalyptus umbra*) in the Warringah area. A sparse layer of small trees such as *Allocasuarina littoralis* and old-man banksia (*Banksia serrata*) is common above a variety of wattles, tea-trees, gee bungs and grass trees. In long unburnt areas sweet pittosporum (*Pittosporum undulatum*) may be prevalent. It is widespread on the Hornsby Plateau in areas that receive greater than 1000 mm of mean annual rainfall and at elevations less than 200 metres above sea level. It extends north of the SMCMA into the hinterland of the central coast and west to the footslopes of the northern Blue Mountains.

One of the distinguishing features of the community is that it appears to persist in areas that have subtle clay enrichment to the sandstone soils. Typically sites are located downslope from large residual shale caps or on exposed Narrabeen sandstone or thin clay bands on coastal sandstone ridgetops. The clay influence is not immediately discernable at sites but does appear expressed in the plant assemblage resulting in more prominent mesic species and a less abundant heath species than sheltered forests found on rockier and more siliceous sandstones.

**Table 12 Vegetation recorded in the study area**

<b>Name</b>	Silvertop Ash-Brown Stringybark Forest (Smith & Smith 2005)
<b>Extent within subject site (approx)</b>	4.5 ha
<b>Description</b>	<p>Description: Open-forest or woodland, typically the former, with a mixed and varying tree species composition. The main tree species are <i>Angophora costata</i> (Sydney Red Gum), <i>Corymbia gummifera</i> (Red Bloodwood), <i>Eucalyptus capitellata</i> (Brown Stringybark) and <i>E. sieberi</i> (Silvertop Ash). <i>Eucalyptus haemastoma</i> (Broad-leaved Scribbly Gum) is also frequently present, but always in low numbers. Common understorey species are <i>Acacia myrtifolia</i>, <i>Austrostipa pubescens</i>, <i>Banksia serrata</i>, <i>B. spinulosa</i>, <i>Billardiera scandens</i>, <i>Boronia pinnata</i>, <i>Bossiaea obcordata</i>, <i>Cassytha pubescens</i>, <i>Ceratopetalum gummiferum</i>, <i>Comesperma ericinum</i>, <i>Cyathochaeta diandra</i>, <i>Dianella caerulea</i>, <i>Dillwynia retorta</i>, <i>Entolasia stricta</i>, <i>Epacris pulchella</i>, <i>Gonocarpus teucroides</i>, <i>Grevillea buxifolia</i>, <i>Grevillea linearifolia</i>, <i>Hakea sericea</i>, <i>Hibbertia bracteata</i>, <i>Imperata cylindrica</i>, <i>Lasiopetalum ferrugineum</i>, <i>Lepidosperma laterale</i>, <i>Leptospermum trinervium</i>, <i>Lindsaea linearis</i>, <i>Lomandra obliqua</i>, <i>Lomandra multiflora</i>, <i>Lomatia silaifolia</i>, <i>Micrantheum ericoides</i>, <i>Patersonia glabrata</i>, <i>P. sericea</i>, <i>Persoonia levis</i>, <i>P. pinifolia</i>, <i>Phyllanthus hirtellus</i>, <i>Platysace linearifolia</i>, <i>Pteridium esculentum</i>, <i>Pultenaea tuberculata</i>, <i>Tetrarrhena juncea</i>, <i>Xanthorrhoea media</i> and <i>Xanthosia tridentata</i>.</p> <p>Habitat: Associated with shale lenses in Hawkesbury Sandstone, usually where these form ridgetop cappings over the sandstone. Thus the community is usually found upslope of Hawkesbury Sandstone communities such as Bloodwood-Scribbly Gum Woodland and Angophora-Peppermint Forest. However, it may also occur in a mid-slope band, where a shale lens outcrops between sandstone layers. Soils are slightly more fertile and have a higher clay content than normal Hawkesbury Sandstone ridgetop soils. They are typically lateritic, characterised by the presence of ironstone gravel. Rock outcrops are normally absent except on the fringes of the community.</p>
<b>Condition</b>	Most of the study area is in moderate to good condition with small weed infested patches in low to highly disturbed condition along pathways and around margins of Area A & B west of Bantry Bay Road.
<b>Threatened species of plant?</b>	None recorded
<b>Threatened community?</b>	Yes, Duffys Forest Endangered Ecological Community



**Table 13 Floristic plots – winter and spring survey 2012**

Stratum / substratum	Species	Percentage cover	Abundance
<b>Area A: Plot 1 (Winter)</b>			
Overstorey – native	<i>Allocasuarina littoralis</i>	5	13
	<i>Angophora costata</i>	10	4
	<i>Eucalyptus resinifera</i>	5	1
	<i>Eucalyptus umbra</i>	1	1
Midstorey – native	<i>Acacia floribunda</i>	1	2
	<i>Acacia irrorata</i>	5	15
	<i>Acacia linifolia</i>	1	1
	<i>Acacia longifolia</i>	1	3
	<i>Acacia myrtifolia</i>	1	1
	<i>Bursaria spinosa</i>	1	2
	<i>Callistemon linearis</i>	1	2
	<i>Dillwynia retorta</i>	1	2
	<i>Dodonaea triquetra</i>	15	25
	<i>Grevillea linearifolia</i>	1	1
	<i>Hakea dactyloides</i>	1	1
	<i>Leptospermum trinervium</i>	1	2
	<i>Persoonia levis</i>	1	2
	<i>Persoonia pinifolia</i>	1	1
	<i>Pittosporum undulatum</i>	5	15
	<i>Polyscias sambucifolia</i>	1	1
Ground – native grasses	<i>Entolasia stricta</i>	35	1000
	<i>Imperata cylindrica</i>	1	10
	<i>Microlaena stipoides</i>	5	100
Ground – native subshrubs	<i>Epacris pulchella</i>	2	50
	<i>Lomatia silaifolia</i>	1	1
	<i>Olearia microphylla</i>	3	25
	<i>Opercularia aspera</i>	1	3
	<i>Phyllota phyllicoides</i>	1	5
	<i>Prostanthera denticulata</i>	2	50
	<i>Pultenaea hispidula</i>	1	2

Stratum / substratum	Species	Percentage cover	Abundance
	<i>Pultenaea scabra</i>	3	25
Ground – native ‘other’	<i>Billardiera scandens</i>	1	1
	<i>Dianella caerulea</i>	1	5
	<i>Gahnia erythrocarpa</i>	1	7
	<i>Gahnia radula</i>	55	1000
	<i>Gleichenia dicarpa</i>	1	1
	<i>Gonocarpus teuroides</i>	1	5
	<i>Lindsaea linearis</i>	1	5
	<i>Lindsaea microphylla</i>	1	5
	<i>Lomandra longifolia</i>	1	5
	<i>Lomandra obliqua</i>	1	3
	<i>Phyllanthus hirtellus</i>	1	3
	<i>Pratia purpurascens</i>	1	15
	<i>Pteridium esculentum</i>	2	10
	<i>Smilax glycyphylla</i>	1	5
	<i>Xanthosia tridentata</i>	1	1
<b>Area A: Plot 2 (Spring)</b>			
Overstorey – native	<i>Allocasuarina littoralis</i>	5	10
	<i>Angophora costata</i>	10	6
	<i>Eucalyptus umbra</i>	5	3
Midstorey – native	<i>Acacia linifolia</i>	2	10
	<i>Acacia longissima</i>	1	1
	<i>Acacia myrtifolia</i>	1	1
	<i>Callistemon linearis</i>	1	25
	<i>Ceratopetalum gummiferum</i>	1	1
	<i>Gahnia erythrocarpa</i>	1	2
	<i>Hakea dactyloides</i>	1	1
	<i>Leptospermum trinervium</i>	5	15
	<i>Pittosporum undulatum</i>	1	2
	<i>Viminaria juncea</i>	1	2
Ground – native grasses	<i>Austrodanthonia tenuior</i>	1	10
	<i>Entolasia stricta</i>	35	1000

Stratum / substratum	Species	Percentage cover	Abundance
Ground – native subshrubs	<i>Epacris pulchella</i>	2	50
	<i>Leptospermum polygalifolium</i>	1	2
	<i>Olearia microphylla</i>	3	25
	<i>Polyscias sambucifolia</i>	1	3
	<i>Prostanthera denticulata</i>	5	50
	<i>Pultenaea daphnoides</i>	1	1
Ground – native ‘other’	<i>Adiantum aethiopicum</i>	1	3
	<i>Dianella caerulea</i>	1	15
	<i>Gahnia radula</i>	55	1000
	<i>Gleichenia dicarpa</i>	1	5
	<i>Goodenia heterophylla</i>	1	1
	<i>Lindsaea linearis</i>	1	5
	<i>Lomandra longifolia</i>	1	5
	<i>Pratia purpurascens</i>	1	50
	<i>Pteridium esculentum</i>	2	25
	<i>Veronica plebeia</i>	1	5
	<i>Xanthosia tridentata</i>	5	100
<b>Area A: Plot 3 (Spring)</b>			
Overstorey – native	<i>Angophora costata</i>	5	2
Midstorey – native	<i>Callistemon linearis</i>	2	5
	<i>Dodonaea triquetra</i>	1	2
	<i>Gahnia erythrocarpa</i>	1	1
	<i>Leptospermum trinervium</i>	30	50
Ground – native grasses	<i>Entolasia stricta</i>	5	50
Ground – native subshrubs	<i>Epacris pulchella</i>	1	10
	<i>Phyllota phyllicoides</i>	1	1
	<i>Prostanthera denticulata</i>	1	20
	<i>Pultenaea daphnoides</i>	1	1
	<i>Pultenaea scabra</i>	5	50
	<i>Rubus fruticosus</i>	1	3
Ground – native ‘other’	<i>Centella asiatica</i>	5	100
	<i>Convolvulus erubescens</i>	1	1

Stratum / substratum	Species	Percentage cover	Abundance
	<i>Dianella caerulea</i>	1	4
	<i>Gahnia radula</i>	10	100
	<i>Glycine microphylla</i>	1	5
	<i>Gonocarpus teucrioides</i>	1	50
	<i>Hibbertia empetrifolia</i>	1	1
	<i>Lepidosperma filiforme</i>	1	1
	<i>Lomandra longifolia</i>	1	10
	<i>Schoenus imberbis</i>	15	500
	<i>Xanthosia tridentata</i>	2	50
Midstorey - exotic	<i>Ligustrum lucidum</i>	1	1
<b>Area A: Plot 4 (Spring)</b>			
Overstorey - native	<i>Allocasuarina littoralis</i>	25	20
	<i>Angophora costata</i>	35	12
	<i>Eucalyptus resinifera</i>	1	1
	<i>Eucalyptus robusta</i>	5	2
	<i>Eucalyptus umbra</i>	10	1
Midstorey – native	<i>Acacia floribunda</i>	1	3
	<i>Acacia irrorata</i>	1	1
	<i>Acacia linifolia</i>	5	15
	<i>Acacia longissima</i>	1	5
	<i>Bursaria spinosa</i>	1	1
	<i>Glochidion ferdinandi</i>	1	2
	<i>Grevillea linearifolia</i>	2	15
	<i>Hakea dactyloides</i>	1	1
	<i>Homalanthus populifolius</i>	1	1
	<i>Lasiopetalum ferrugineum</i>	1	10
	<i>Ozothamnus diosmifolius</i>	1	5
	<i>Polyscias sambucifolia</i>	1	3
Ground – native grasses	<i>Entolasia marginata</i>	10	100
	<i>Entolasia stricta</i>	35	1000
	<i>Imperata cylindrica</i>	1	10
	<i>Microlaena stipoides</i>	1	10

Stratum / substratum	Species	Percentage cover	Abundance
	<i>Oplismenus imbecillis</i>	2	50
	<i>Tetrarrhena juncea</i>	1	10
Ground – native subshrubs	<i>Micrantheum ericoides</i>	1	35
	<i>Prostanthera denticulata</i>	1	20
	<i>Pultenaea daphnoides</i>	1	15
	<i>Pultenaea hispidula</i>	1	10
Ground – native ‘other’	<i>Adiantum aethiopicum</i>	1	5
	<i>Cassytha glabella</i>	1	1
	<i>Clematis aristata</i>	1	1
	<i>Dianella caerulea</i>	2	50
	<i>Gahnia radula</i>	45	1000
	<i>Glycine microphylla</i>	1	20
	<i>Gonocarpus teucrioides</i>	1	20
	<i>Hibbertia empetrifolia</i>	1	1
	<i>Hypolepis muelleri</i>	5	50
	<i>Lepidosperma filiforme</i>	1	5
	<i>Lindsaea microphylla</i>	1	1
	<i>Lomandra longifolia</i>	10	100
	<i>Pratia purpurascens</i>	1	50
	<i>Pteridium esculentum</i>	1	5
	<i>Smilax glycyphylla</i>	1	3
	<i>Xanthosia pilosa</i>	1	2
	<i>Xanthosia tridentata</i>	1	25
Midstorey - exotic	<i>Ochna serrulata</i>	1	50
<b>Area A: Plot 5 (Spring)</b>			
Overstorey – native	<i>Angophora costata</i>	25	2
	<i>Eucalyptus saligna</i>	5	1
	<i>Eucalyptus umbra</i>	10	3
Midstorey – native	<i>Acacia longissima</i>	1	5
	<i>Pittosporum undulatum</i>	10	5
Ground – native grasses	<i>Cynodon dactylon</i>	25	500
	<i>Imperata cylindrica</i>	15	500

Stratum / substratum	Species	Percentage cover	Abundance
Ground – native ‘other’	<i>Dianella caerulea</i>	1	20
	<i>Lomandra longifolia</i>	5	10
Midstorey - exotic	<i>Cotoneaster glaucophyllus</i>	10	5
	<i>Lantana camara</i>	2	5
	<i>Ligustrum lucidum</i>	5	2
	<i>Ligustrum sinense</i>	1	3
	<i>Polygala myrtifolia</i>	3	1
	<i>Sida rhombifolia</i>	5	50
Ground – exotic	<i>Andropogon virginicus</i>	2	50
	<i>Asparagus aethiopicus</i>	1	5
	<i>Bidens pilosa</i>	5	50
	<i>Briza maxima</i>	2	100
	<i>Conyza bonariensis</i>	1	20
	<i>Hypochaeris radicata</i>	1	5
	<i>Lonicera japonica</i>	10	15
	<i>Paspalum quadrifarium</i>	20	100
	<i>Plantago lanceolata</i>	1	20
	<i>Pennisetum clandestinum</i>	5	50
<b>Area B: Plot 1 (Winter)</b>			
Overstorey – native	<i>Allocasuarina littoralis</i>	15	5
	<i>Angophora costata</i>	10	5
	<i>Corymbia gummifera</i>	10	1
	<i>Eucalyptus resinifera</i>	5	1
	<i>Eucalyptus robusta</i>	1	1
	<i>Eucalyptus umbra</i>	2	1
Midstorey – native	<i>Acacia irrorata</i>	2	10
	<i>Acacia myrtifolia</i>	1	1
	<i>Gahnia erythrocarpa</i>	1	1
	<i>Leptospermum trinervium</i>	30	23
	<i>Persoonia levis</i>	1	1
	<i>Persoonia pinifolia</i>	10	4
	<i>Pittosporum undulatum</i>	1	1

Stratum / substratum	Species	Percentage cover	Abundance
Ground – native grasses	<i>Entolasia stricta</i>		
	<i>Microlaena stipoides</i>	5	15
Ground – native subshrubs	<i>Epacris pulchella</i>	1	1
	<i>Lasiopetalum ferrugineum</i>	1	1
	<i>Prostanthera denticulata</i>	1	10
	<i>Pultenaea hispidula</i>	1	3
	<i>Xanthorrhoea media</i>	1	1
Ground – native 'other'	<i>Caustis flexuosa</i>	45	500
	<i>Dianella caerulea</i>	2	15
	<i>Gahnia radula</i>	1	5
	<i>Gonocarpus teuroides</i>	1	10
	<i>Hypolepis muelleri</i>	1	1
	<i>Lomandra longifolia</i>	1	3
	<i>Lomandra obliqua</i>	15	500
	<i>Patersonia sericea</i>	1	1
	<i>Pratia purpurascens</i>	1	20
<b>Area B: Plot 2 (Spring)</b>			
Overstorey – native	<i>Allocasuarina littoralis</i>	30	25
	<i>Angophora costata</i>	10	5
	<i>Corymbia gummifera</i>	5	1
	<i>Eucalyptus resinifera</i>	1	1
	<i>Eucalyptus umbra</i>	5	2
Midstorey – native	<i>Acacia floribunda</i>	2	10
	<i>Acacia linifolia</i>	1	5
	<i>Acacia longissima</i>	1	1
	<i>Acacia myrtifolia</i>	1	3
	<i>Choretrum candollei</i>	1	1
	<i>Glochidion ferdinandi</i>	1	1
	<i>Grevillea linearifolia</i>	1	5
	<i>Lasiopetalum ferrugineum</i>	1	10
	<i>Leptospermum trinervium</i>	5	15
	<i>Melaleuca hypericifolia</i>	1	1



Stratum / substratum	Species	Percentage cover	Abundance
	<i>Persoonia levis</i>	1	1
	<i>Pittosporum undulatum</i>	5	10
Ground – native grasses	<i>Entolasia marginata</i>	1	10
	<i>Entolasia stricta</i>	25	1000
	<i>Imperata cylindrica</i>	2	50
	<i>Microlaena stipoides</i>	1	20
Ground – native subshrubs	<i>Lomatia silaifolia</i>	1	1
	<i>Micrantheum ericoides</i>	1	35
	<i>Olearia microphylla</i>	5	50
	<i>Polyscias sambucifolia</i>	2	20
	<i>Prostanthera denticulata</i>	5	100
Ground – native ‘other’	<i>Adiantum aethiopicum</i>	1	3
	<i>Caustis flexuosa</i>	50	1000
	<i>Centella asiatica</i>	1	20
	<i>Dianella caerulea</i>	1	15
	<i>Hibbertia empetrifolia</i>	1	5
	<i>Lepidosperma filiforme</i>	5	50
	<i>Lomandra longifolia</i>	5	5
	<i>Lomandra multiflora</i>	1	2
	<i>Lomandra obliqua</i>	20	1000
	<i>Pratia purpurascens</i>	2	50
	<i>Smilax glyciphylla</i>	1	1
	<i>Xanthosia pilosa</i>	1	10
	<i>Xanthosia tridentata</i>	1	50
Ground – exotic	<i>Ochna serrulata</i>	1	1
<b>Area B: Plot 3 (Spring)</b>			
Overstorey – native	<i>Allocasuarina littoralis</i>	25	15
	<i>Angophora costata</i>	30	5
	<i>Eucalyptus resinifera</i>	5	1
	<i>Eucalyptus robusta</i>	5	1
	<i>Eucalyptus umbra</i>	5	2
Midstorey – native	<i>Acacia floribunda</i>	1	3

Stratum / substratum	Species	Percentage cover	Abundance
	<i>Acacia irrorata</i>	1	1
	<i>Acacia linifolia</i>	3	15
	<i>Acacia myrtifolia</i>	1	3
	<i>Glochidion ferdinandi</i>	1	1
	<i>Grevillea linearifolia</i>	2	5
Ground – native grasses	<i>Austrostipa pubescens</i>	5	50
	<i>Deyeuxia decipiens</i>	15	100
	<i>Microlaena stipoides</i>	1	10
Ground – native subshrubs	<i>Bossiaea obcordata</i>	5	20
	<i>Notelaea longifolia</i>	1	1
	<i>Olearia microphylla</i>	2	20
	<i>Phyllota phyllicoides</i>	1	5
	<i>Polyscias sambucifolia</i>	1	2
	<i>Pultenaea daphnoides</i>	1	1
	<i>Xanthorrhoea media</i>	1	3
Ground – native ‘other’	<i>Burchardia umbellata</i>	1	5
	<i>Dianella caerulea</i>	1	20
	<i>Glycine microphylla</i>	1	5
	<i>Gonocarpus teucrioides</i>	1	15
	<i>Lepidosperma filiforme</i>	15	100
	<i>Lepidosperma laterale</i>	1	10
	<i>Lomandra gracilis</i>	1	20
	<i>Lomandra longifolia</i>	10	50
	<i>Lomandra multiflora</i>	1	5
	<i>Lomandra obliqua</i>	10	500
	<i>Pratia purpurascens</i>	1	30
	<i>Pteridium esculentum</i>	2	15
	<i>Smilax glyciophylla</i>	1	2
<b>Area C: Plot 1 (Winter)</b>			
Overstorey – native	<i>Allocasuarina littoralis</i>	25	10
	<i>Angophora costata</i>	35	2
	<i>Corymbia gummifera</i>	1	1

Stratum / substratum	Species	Percentage cover	Abundance
	<i>Eucalyptus resinifera</i>	1	1
Midstorey – native	<i>Acacia linifolia</i>	5	15
	<i>Acacia myrtifolia</i>	1	5
	<i>Banksia serrata</i>	1	1
	<i>Dodonaea triquetra</i>	5	10
	<i>Lepidosperma laterale</i>	1	2
	<i>Persoonia levis</i>	1	1
	<i>Polyscias sambucifolia</i>	1	1
Ground – native grasses	<i>Entolasia stricta</i>	35	1000
	<i>Microlaena stipoides</i>	5	500
Ground – native subshrubs	<i>Epacris pulchella</i>	2	25
	<i>Lasiopetalum ferrugineum</i>	1	15
	<i>Prostanthera denticulata</i>	10	25
	<i>Pultenaea hispidula</i>	1	20
	<i>Pultenaea scabra</i>	1	10
Ground – native ‘other’	<i>Billardiera scandens</i>	1	1
	<i>Caustis flexuosa</i>	20	1000
	<i>Clematis aristata</i>	1	2
	<i>Cyathochaeta diandra</i>	1	5
	<i>Dianella caerulea</i>	3	50
	<i>Gahnia radula</i>	1	5
	<i>Gonocarpus teuroides</i>	1	10
	<i>Lindsaea linearis</i>	1	50
	<i>Lomandra longifolia</i>	1	15
	<i>Phyllanthus hirtellus</i>	1	50
	<i>Platylobium formosum</i>	1	5
	<i>Pratia purpurascens</i>	1	15
	<i>Xanthosia tridentata</i>	3	50
<b>Area C: Plot 2 (Spring)</b>			
Overstorey - native	<i>Allocasuarina littoralis</i>	35	15
	<i>Angophora costata</i>	25	5
	<i>Corymbia gummifera</i>	1	1

Stratum / substratum	Species	Percentage cover	Abundance
	<i>Eucalyptus resinifera</i>	1	1
	<i>Eucalyptus umbra</i>	10	1
Midstorey – native	<i>Acacia floribunda</i>	3	10
	<i>Acacia irrorata</i>	1	5
	<i>Acacia linifolia</i>	1	1
	<i>Acacia longissima</i>	1	1
	<i>Acacia myrtifolia</i>	1	2
	<i>Banksia serrata</i>	1	1
	<i>Ceratopetalum apetalum</i>	1	1
	<i>Ceratopetalum gummiferum</i>	1	1
	<i>Dodonaea triquetra</i>	3	20
	<i>Elaeocarpus reticulatus</i>	1	1
	<i>Glochidion ferdinandi</i>	1	2
	<i>Homalanthus populifolius</i>	1	1
	<i>Lasiopetalum ferrugineum</i>	2	20
	<i>Persoonia levis</i>	1	1
	<i>Persoonia pinifolia</i>	1	5
	<i>Pittosporum undulatum</i>	5	3
	<i>Polyscias sambucifolia</i>	1	5
	<i>Austrodanthonia tenuior</i>	1	5
Ground – native grasses	<i>Entolasia stricta</i>	25	1000
	<i>Oplismenus aemulus</i>	1	50
Ground – native subshrubs	<i>Epacris pulchella</i>	1	25
	<i>Prostanthera denticulata</i>	2	50
Ground – native ‘other’	<i>Clematis aristata</i>	1	10
	<i>Dianella caerulea</i>	1	15
	<i>Gahnia radula</i>	20	1000
	<i>Glycine microphylla</i>	1	50
	<i>Gonocarpus teucrioides</i>	1	25
	<i>Lepidosperma filiforme</i>	3	50
	<i>Lindsaea microphylla</i>	1	5
	<i>Lomandra longifolia</i>	15	100

Stratum / substratum	Species	Percentage cover	Abundance
	<i>Oxalis exilis</i>	1	50
	<i>Phyllanthus hirtellus</i>	1	15
	<i>Pratia purpurascens</i>	1	50
	<i>Pteridium esculentum</i>	2	50
	<i>Smilax glycyphylla</i>	1	5
	<i>Xanthosia pilosa</i>	3	100
Midstorey – exotic	<i>Ligustrum lucidum</i>	3	2
	<i>Ligustrum sinense</i>	1	1
	<i>Senna pendula</i>	1	5
Ground – exotic	<i>Passiflora edulis</i>	1	1
<b>Area C: Plot 3 (Spring)</b>			
Overstorey - native	<i>Allocasuarina littoralis</i>	30	15
	<i>Angophora costata</i>	25	2
	<i>Eucalyptus resinifera</i>	5	1
	<i>Eucalyptus umbra</i>	10	4
Midstorey – native	<i>Acacia irrorata</i>	1	1
	<i>Acacia ulicifolia</i>	1	1
	<i>Callicoma serratifolia</i>	1	3
	<i>Ceratopetalum apetalum</i>	1	5
	<i>Dodonaea triquetra</i>	3	15
	<i>Gahnia erythrocarpa</i>	1	5
	<i>Glochidion ferdinandi</i>	1	2
	<i>Grevillea linearifolia</i>	1	1
	<i>Lasiopetalum ferrugineum</i>	1	3
	<i>Notelaea longifolia</i>	1	2
	<i>Persoonia levis</i>	1	4
	<i>Persoonia linearis</i>	1	2
	<i>Pittosporum undulatum</i>	10	5
	<i>Polyscias sambucifolia</i>	3	15
	<i>Pultenaea villosa</i>	2	10
Ground – native grasses	<i>Entolasia stricta</i>	30	1000
	<i>Oplismenus imbecillis</i>	2	100

Stratum / substratum	Species	Percentage cover	Abundance
	<i>Tetrarrhena juncea</i>	1	50
Ground – native subshrubs	<i>Lomatia silaifolia</i>	1	5
	<i>Micrantheum ericoides</i>	1	30
	<i>Prostanthera denticulata</i>	1	25
	<i>Xanthorrhoea media</i>	1	1
Ground – native ‘other’	<i>Blechnum cartilagineum</i>	1	1
	<i>Clematis aristata</i>	1	10
	<i>Dianella caerulea</i>	3	30
	<i>Gonocarpus teucrioides</i>	1	15
	<i>Hypolepis muelleri</i>	1	20
	<i>Lepidosperma filiforme</i>	2	30
	<i>Lomandra longifolia</i>	25	500
	<i>Plectranthus parviflorus</i>	1	50
	<i>Pratia purpurascens</i>	1	50
	<i>Pteridium esculentum</i>	3	100
	<i>Schoenus melanostachys</i>	1	1
	<i>Xanthosia pilosa</i>	1	30
Midstorey – exotic	<i>Ligustrum sinense</i>	1	5
Ground – exotic	<i>Lonicera japonica</i>	1	3
<b>Area C: Plot 4 (Spring)</b>			
Overstorey - native	<i>Angophora costata</i>	30	1
	<i>Corymbia gummifera</i>	5	1
	<i>Eucalyptus robusta</i>	10	1
	<i>Eucalyptus saligna</i>	5	1
	<i>Eucalyptus umbra</i>	5	1
	<i>Melaleuca quinquenervia</i>	5	3
Midstorey – native	<i>Acacia fimbriata</i>	5	1
	<i>Pittosporum undulatum</i>	10	5
Ground – native grasses	<i>Cynodon dactylon</i>	5	50
Ground – native ‘other’	<i>Cyperus gracilis</i>	1	50
	<i>Dichondra repens</i>	5	100
	<i>Oxalis exilis</i>	1	20

Stratum / substratum	Species	Percentage cover	Abundance
	<i>Pratia purpurascens</i>	1	50
	<i>Pteridium esculentum</i>	2	15
	<i>Rumex brownii</i>	1	1
Midstorey – exotic	<i>Lantana camara</i>	20	5
	<i>Ligustrum sinense</i>	15	5
	<i>Senna pendula</i>	1	2
Ground – exotic	<i>Ageratina adenophora</i>	1	5
	<i>Asparagus aethiopicus</i>	1	3
	<i>Axonopus fissifolius</i>	5	100
	<i>Bromus catharticus</i>	2	50
	<i>Cirsium vulgare</i>	1	5
	<i>Delairea odorata</i>	2	5
	<i>Ehrharta erecta</i>	20	500
	<i>Hypochaeris radicata</i>	1	10
	<i>Lonicera japonica</i>	2	3
	<i>Pennisetum clandestinum</i>	30	1000
	<i>Plantago lanceolata</i>	1	15
	<i>Solanum nigrum</i>	1	3
	<i>Stenotaphrum secundatum</i>	25	500
	<i>Tradescantia fluminensis</i>	5	100

**Table 14 BioMetric transects – winter and spring surveys**

	Native overstorey	fc	Regen	Native midstorey	fc	Native ground cover (grasses)	Tally	Native ground cover (subshrubs)	Tally	Native ground cover (other)	Tally	Exotic shrubs	fc	Exotic ground cover	Tally	Fallen logs
Area A: Transect I (Winter)																
1	<i>Angophora costata</i>	40		<i>Acacia floribunda</i>	15	<i>Entolasia stricta</i>	11	<i>Prostanthera denticulata</i>	2	<i>Gahnia radula</i>	16					
2				<i>Acacia floribunda</i>	10	<i>Oplismenus aemulus</i>	3			<i>Lomandra longifolia</i>	8	<i>Lantana camara</i>	1			
3				<i>Dodonaea triquetra</i>	20					<i>Lepidosperma filiforme</i>	10					
4	<i>Eucalyptus umbra</i>	35		<i>Dodonaea triquetra</i>	35											
5	<i>Eucalyptus umbra</i>	40										<i>Senna pendula</i>	2			
6				<i>Lasiopetalum ferrugineum</i>	5											
7				<i>Dodonaea triquetra</i>	15											
8	<i>Eucalyptus umbra</i>	30		<i>Dodonaea triquetra</i>	45											
9	<i>Allocasuarina littoralis</i>	20		<i>Dodonaea triquetra</i>	25							<i>Ligustrum lucidum</i>	5			
10	<i>Angophora costata</i>	55		<i>Acacia irrorata</i>	25											
no. spp	4			5		2		1		3		3				23m
F.cov%	18			18		28		4		68		8				



	Native overstorey	fc	Regen	Native midstorey	fc	Native ground cover (grasses)	Tally	Native ground cover (subshrubs)	Tally	Native ground cover (other)	Tally	Exotic shrubs	fc	Exotic ground cover	Tally	Fallen logs
Area A: Transect 2 (Spring)																
1	<i>Allocasuarina littoralis</i>	15		<i>Leptospermum trinervium</i>	25	<i>Entolasia stricta</i>	15	<i>Prostanthera denticulata</i>	7	<i>Gahnia radula</i>	17					
2	<i>Angophora costata</i>	45						<i>Epacris pulchella</i>	3	<i>Xanthosia tridentata</i>	1					
3	<i>Allocasuarina littoralis</i>	20		<i>Leptospermum trinervium</i>	15			<i>Olearia microphylla</i>	6	<i>Pteridium esculentum</i>	1					
4																
5	<i>Eucalyptus umbra</i>	45														
6				<i>Callistemon linearis</i>	15											
7	<i>Allocasuarina littoralis</i>	35														
8				<i>Pittosporum undulatum</i>	15											
9	<i>Angophora costata</i>	25		<i>Leptospermum trinervium</i>	25											
10	<i>Angophora costata</i>	55														
no. spp	3			3		1		3		3						8m
F.cov%	24			9.5		30		32		38		0		0		

	Native overstorey	fc	Regen	Native midstorey	fc	Native ground cover (grasses)	Tally	Native ground cover (subshrubs)	Tally	Native ground cover (other)	Tally	Exotic shrubs	fc	Exotic ground cover	Tally	Fallen logs
Area A: Transect 3 (Spring)																
1	<i>Angophora costata</i>	25		<i>Leptospermum trinervium</i>	25	<i>Entolasia stricta</i>	21	<i>Epacris pulchella</i>	1	<i>Centella asiatica</i>	1					
2				<i>Leptospermum trinervium</i>	35			<i>Prostanthera denticulata</i>	1	<i>Schoenus imberbis</i>	9					
3				<i>Leptospermum trinervium</i>	25					<i>Gahnia radula</i>	13					
4				<i>Leptospermum trinervium</i>	35						4					
5				<i>Leptospermum trinervium</i>	30											
6																
7																
8																
9				<i>Dodonaea triquetra</i>	15							<i>Ligustrum lucidum</i>	45			
10																
no. spp	1			1		1		2		3		1		0		0 m
F.cov%	2.5			16.5		42		4		54		4.5				

	Native overstorey	fc	Regen	Native midstorey	fc	Native ground cover (grasses)	Tally	Native ground cover (subshrubs)	Tally	Native ground cover (other)	Tally	Exotic shrubs	fc	Exotic ground cover	Tally	Fallen logs
Area A: Transect 4 (Spring)																
1	<i>Angophora costata</i>	60		<i>Grevillea linearifolia</i>	10	<i>Entolasia stricta</i>	15	<i>Micrantheum ericoides</i>	1	<i>Gahnia radula</i>	18					
2	<i>Eucalyptus umbra</i>	55		<i>Acacia linifolia</i>	25	<i>Entolasia marginata</i>	7			<i>Lomandra longifolia</i>	2					
3	<i>Angophora costata</i>	35		<i>Acacia linifolia</i>	15	<i>Oplismenus imbecillis</i>	5			<i>Hypolepis muelleri</i>	1					
4	<i>Eucalyptus umbra</i>	25				<i>Oplismenus aemulus</i>	1									
5																
6	<i>Angophora costata</i>	45		<i>Grevillea linearifolia</i>	15											
7	<i>Angophora costata</i>	35														
8	<i>Eucalyptus resinifera</i>	45		<i>Grevillea linearifolia</i>	5											
9	<i>Eucalyptus umbra</i>	55														
10	<i>Angophora costata</i>	60		<i>Lasiopetalum ferrugineum</i>	2											
no. spp	4			5		2		1								35 m
F.cov%	41.5			7.2		56		2		42		0				

	Native overstorey	fc	Regen	Native midstorey	fc	Native ground cover (grasses)	Tally	Native ground cover (subshrubs)	Tally	Native ground cover (other)	Tally	Exotic shrubs	fc	Exotic ground cover	Tally	Fallen logs
Area A: Transect 5 (Spring)																
1	<i>Angophora costata</i>	65		<i>Pittosporum undulatum</i>	25	<i>Cynodon dactylon</i>	9			<i>Lomandra longifolia</i>	3			<i>Paspalum quadrifarium</i>	7	
2						<i>Imperata cylindrica</i>	2					<i>Ligustrum lucidum</i>	5	<i>Pennisetum clandestinum</i>	3	
3	<i>Eucalyptus saligna</i>	15		<i>Acacia linifolia</i>	10									<i>Lonicera japonica</i>	8	
4				<i>Callistemon linearis</i>	15									<i>Conyza bonariensis</i>	3	
5														<i>Andropogon virginicus</i>	5	
6														<i>Bidens pilosa</i>	1	
7	<i>Eucalyptus umbra</i>	55										<i>Cotoneaster glaucophyllus</i>	15			
8	<i>Eucalyptus umbra</i>	45		<i>Pittosporum undulatum</i>	45											
9																
10	<i>Eucalyptus saligna</i>	55		<i>Pittosporum undulatum</i>	35											
no. spp	3			5		2		0		1		2		6		0 m
F.cov%	23.5			13		22		0		6		2		54		

	Native overstorey	fc	Regen	Native midstorey	fc	Native ground cover (grasses)	Tally	Native ground cover (subshrubs)	Tally	Native ground cover (other)	Tally	Exotic shrubs	fc	Exotic ground cover	Tally	Fallen logs
Area B: Transect I (Winter)																
1	<i>Angophora costata</i>	40		<i>Leptospermum trinervium</i>	25	<i>Entolasia stricta</i>	5	<i>Olearia microphylla</i>	1	<i>Caustis flexuosa</i>	22					
2	<i>Allocasuarina littoralis</i>	25		<i>Pittosporum undulatum</i>	25	<i>Imperata cylindrica</i>	1	<i>Prostanthera denticulata</i>	1	<i>Lomandra obliqua</i>	2					
3	<i>Eucalyptus umbra</i>	50						<i>Micrantheum ericoides</i>	1	<i>Lomandra longifolia</i>	1					
4	<i>Allocasuarina littoralis</i>	55		<i>Acacia linifolia</i>	15					<i>Lepidosperma filiforme</i>	1					
5	<i>Allocasuarina littoralis</i>	35		<i>Leptospermum trinervium</i>	12											
6	<i>Corymbia gummifera</i>	65		<i>Leptospermum trinervium</i>	15											
7	<i>Angophora costata</i>	55		<i>Acacia linifolia</i>	3											
8				<i>Leptospermum trinervium</i>	25											
9	<i>Angophora costata</i>	60														
10	<i>Angophora costata</i>	50		<i>Leptospermum trinervium</i>	25											
no. spp	4			4		2		3		4		0				23
F.cov%	43.5			14.5		12		6		52		0				0

	Native overstorey	fc	Regen	Native midstorey	fc	Native ground cover (grasses)	Tally	Native ground cover (subshrubs)	Tally	Native ground cover (other)	Tally	Exotic shrubs	fc	Exotic ground cover	Tally	Fallen logs
Area B: Transect 2 (Spring)																
1	<i>Allocasuarina littoralis</i>	35		<i>Pittosporum undulatum</i>	5	<i>Entolasia stricta</i>	25	<i>Olearia microphylla</i>	1	<i>Caustis flexuosa</i>	14					
2	<i>Allocasuarina littoralis</i>	25		<i>Pittosporum undulatum</i>	10	<i>Imperata cylindrica</i>	2	<i>Prostanthera denticulata</i>	3	<i>Lomandra obliqua</i>	2					
3	<i>Corymbia gummifera</i>	55						<i>Micrantheum ericoides</i>	1	<i>Lomandra longifolia</i>	1					
4	<i>Allocasuarina littoralis</i>	30		<i>Acacia linifolia</i>	3					<i>Lepidosperma filiforme</i>	1					
5				<i>Leptospermum trinervium</i>	12											
6	<i>Allocasuarina littoralis</i>	35		<i>Leptospermum trinervium</i>	15											
7	<i>Angophora costata</i>	55		<i>Acacia linifolia</i>	3											
8	<i>Eucalyptus umbra</i>	45		<i>Leptospermum trinervium</i>	25											
9	<i>Angophora costata</i>	60		<i>Acacia floribunda</i>	15											
10	<i>Angophora costata</i>	45		<i>Pittosporum undulatum</i>	5											
no. spp	4			4		2		3		4		0				27m
F.cov%	38.5			9.3		54		10		36		0				

	Native overstorey	fc	Regen	Native midstorey	fc	Native ground cover (grasses)	Tally	Native ground cover (subshrubs)	Tally	Native ground cover (other)	Tally	Exotic shrubs	fc	Exotic ground cover	Tally	Fallen logs
Area B: Transect 3 (Spring)																
1	<i>Eucalyptus umbra</i>	55		<i>Grevillea linearifolia</i>	10	<i>Deyeuxia decipiens</i>	12	<i>Bossiaea obcordata</i>	4	<i>Lepidosperma filiforme</i>	8					
2	<i>Allocasuarina littoralis</i>	35				<i>Austrostipa pubescens</i>	8	<i>Olearia microphylla</i>	3	<i>Lepidosperma laterale</i>	3					
3	<i>Angophora costata</i>	45				<i>Microlaena stipoides</i>	2			<i>Lomandra obliqua</i>	6					
4	<i>Allocasuarina littoralis</i>	35		<i>Acacia linifolia</i>	15					<i>Pteridium esculentum</i>	1					
5	<i>Angophora costata</i>	60		<i>Grevillea linearifolia</i>	20					<i>Pratia purpurascens</i>	2					
6	<i>Eucalyptus resinifera</i>	65								<i>Lomandra gracilis</i>	1					
7	<i>Angophora costata</i>	60														
8	<i>Allocasuarina littoralis</i>	40														
9	<i>Allocasuarina littoralis</i>	35		<i>Acacia linifolia</i>	25											
10	<i>Eucalyptus umbra</i>	45														
no. spp	4			2		3		2		6						7m
F.cov%	47.5			7		44		14		42		0				

	Native overstorey	fc	Regen	Native midstorey	fc	Native ground cover (grasses)	Tally	Native ground cover (subshrubs)	Tally	Native ground cover (other)	Tally	Exotic shrubs	fc	Exotic ground cover	Tally	Fallen logs
Area C: Transect I (Winter)																
1	<i>Allocasuarina littoralis</i>	20				<i>Entolasia stricta</i>	29	<i>Prostanthera denticulata</i>	1	<i>Gahnia radula</i>	11					
2				<i>Acacia floribunda</i>	10	<i>Oplismenus aemulus</i>	3			<i>Lomandra longifolia</i>	3	<i>Lantana camara</i>	25			
3	<i>Allocasuarina littoralis</i>	35								<i>Lepidosperma filiforme</i>	2					
4	<i>Allocasuarina littoralis</i>	15		<i>Dodonaea triquetra</i>	5							<i>Ligustrum sinense</i>	45			
5	<i>Eucalyptus umbra</i>	40		<i>Acacia floribunda</i>	2											
6	<i>Corymbia gummifera</i>	25		<i>Lasiopetalum ferrugineum</i>	2											
7				<i>Dodonaea triquetra</i>	15							<i>Senna pendula</i>	5			
8	<i>Eucalyptus umbra</i>	30		<i>Glochidion ferdinandi</i>	10											
9	<i>Eucalyptus umbra</i>	25		<i>Pittosporum undulatum</i>	25											
10	<i>Angophora costata</i>	55		<i>Acacia floribunda</i>	15							<i>Ligustrum lucidum</i>	30			
no. spp	4			5		2		1		3		4				15 m
F.cov%	24.5			8.4		64		2		32		10.5				



	Native overstorey	fc	Regen	Native midstorey	fc	Native ground cover (grasses)	Tally	Native ground cover (subshrubs)	Tally	Native ground cover (other)	Tally	Exotic shrubs	fc	Exotic ground cover	Tally	Fallen logs
Area C: Transect 2 (Spring)																
1	<i>Allocasuarina littoralis</i>	20		<i>Dodonaea triquetra</i>	25	<i>Entolasia stricta</i>	21	<i>Prostanthera denticulata</i>	1	<i>Gahnia radula</i>	10					
2				<i>Acacia floribunda</i>	10	<i>Oplismenus aemulus</i>	7			<i>Lomandra longifolia</i>	3	<i>Lantana camara</i>	25			
3	<i>Angophora costata</i>	40		<i>Dodonaea triquetra</i>	20					<i>Lepidosperma filiforme</i>	8					
4	<i>Eucalyptus umbra</i>	35		<i>Dodonaea triquetra</i>	5											
5	<i>Eucalyptus umbra</i>	40		<i>Acacia floribunda</i>	2							<i>Senna pendula</i>	10			
6	<i>Corymbia gummifera</i>	45		<i>Lasiopetalum ferrugineum</i>	2											
7				<i>Dodonaea triquetra</i>	15											
8	<i>Eucalyptus umbra</i>	30		<i>Glochidion ferdinandi</i>	2											
9	<i>Eucalyptus umbra</i>	25		<i>Pittosporum undulatum</i>	25							<i>Ligustrum lucidum</i>	55			
10	<i>Angophora costata</i>	55		<i>Acacia floribunda</i>	15											
no. spp	4			5		2		1		3		3				23m
F.cov%	29			12		56		2		42		9				

	Native overstorey	fc	Regen	Native midstorey	fc	Native ground cover (grasses)	Tally	Native ground cover (subshrubs)	Tally	Native ground cover (other)	Tally	Exotic shrubs	fc	Exotic ground cover	Tally	Fallen logs
Area C: Transect 3 (Spring)																
1	<i>Angophora costata</i>	45		<i>Dodonaea triquetra</i>	5	<i>Entolasia stricta</i>	35	<i>Prostanthera denticulata</i>	3	<i>Lomandra longifolia</i>	9			<i>Lonicera japonica</i>	1	
2	<i>Eucalyptus resinifera</i>	30			0					<i>Pteridium esculentum</i>	1					
3	<i>Allocasuarina littoralis</i>	25		<i>Gahnia erythrocarpa</i>	35					<i>Pratia purpurascens</i>	1					
4	<i>Eucalyptus umbra</i>	50		<i>Callicoma serratifolia</i>	25							<i>Ligustrum sinense</i>	45			
5	<i>Allocasuarina littoralis</i>	14		<i>Pultenaea villosa</i>	15											
6	<i>Angophora costata</i>	55		<i>Pittosporum undulatum</i>	5											
7		0		<i>Dodonaea triquetra</i>	5											
8	<i>Eucalyptus umbra</i>	45		<i>Dodonaea triquetra</i>	15											
9	<i>Angophora costata</i>	50			0											
10		0			0											
no. spp	4			5		1		1		3		1		2		15 m
F.cov%	31.4			10.5		70		6		22		4.5		2		

	Native overstorey	fc	Regen	Native midstorey	fc	Native ground cover (grasses)	Tally	Native ground cover (subshrubs)	Tally	Native ground cover (other)	Tally	Exotic shrubs	fc	Exotic ground cover	Tally	Fallen logs
Area C: Transect 4 (Spring)																
1	<i>Angophora costata</i>	65								<i>Dichondra repens</i>	1			<i>Axonopus fissifolius</i>	12	
2	<i>Angophora costata</i>	65								<i>Pteridium esculentum</i>	2			<i>Ehrharta erecta</i>	7	
3	<i>Eucalyptus resinifera</i>	70		<i>Pittosporum undulatum</i>	10					<i>Cyperus gracilis</i>	1			<i>Pennisetum clandestinum</i>	17	
4	<i>Eucalyptus saligna</i>	45												<i>Stenotaphrum secundatum</i>	8	
5																
6	<i>Angophora costata</i>	60										<i>Ligustrum sinense</i>	10			
7	<i>Eucalyptus umbra</i>	55														
8												<i>Lantana camara</i>	20			
9	<i>Eucalyptus resinifera</i>	15														
10																
no. spp	4			1		1		0		3		2		4		0
F.cov%	37.5			1		4		0		8		3		88		

**Table 15 Location of hollow bearing trees in the study area**

MGA Zone	East	North	Species	Small Hollow	Medium Hollow	Large Hollow
56	336188	6263988	<i>Angophora costata</i>	2	0	0
56	336199	6263977	<i>Angophora costata</i>	1	0	0
56	336201	6264002	<i>Angophora costata</i>	1	0	0
56	336205	6264103	<i>Angophora costata</i>	1	0	0
56	336210	6264135	<i>Angophora costata</i>	0	2	1
56	336213	6263972	<i>Angophora costata</i>	1	0	0
56	336218	6264012	<i>Angophora costata</i>	1	0	0
56	336230	6264074	<i>Eucalyptus saligna</i>	0	1	0
56	336232	6264190	<i>Angophora costata</i>	0	0	1
56	336233	6264131	<i>Angophora costata</i>	1	0	1
56	336238	6264029	<i>Angophora costata</i>	1	0	0
56	336257	6264016	<i>Angophora costata</i>	1	0	0
56	336261	6263965	<i>Angophora costata</i>	1	0	0
56	336280	6263971	<i>Angophora costata</i>	1	0	0
56	336295	6264001	<i>Angophora costata</i>	1	0	0
56	336319	6263976	<i>Angophora costata</i>	1	0	0
56	336329	6263959	<i>Angophora costata</i>	1	0	0
56	336335	6264117	<i>Angophora costata</i>	1	0	1
56	336338	6264139	<i>Angophora costata</i>	0	0	1
56	336353	6264048	<i>Angophora costata</i>	0	1	0
56	336353	6264099	<i>Angophora costata</i>	1	0	1
56	336356	6264029	<i>Eucalytus capitellata</i>	6	0	0
56	336369	6263993	<i>Angophora costata</i>	1	0	0
56	336370	6264042	<i>Angophora costata</i>	3	3	1
56	336375	6264145	<i>Eucalyptus umbra</i>	0	2	0
56	336377	6263991	<i>Angophora costata</i>	1	0	0
56	336378	6264129	<i>Eucalytus capitellata</i>	1	0	0
56	336380	6264008	<i>Angophora costata</i>	1	0	0
56	336381	6264028	<i>Angophora costata</i>	3	0	0
56	336384	6264072	<i>Eucalyptus umbra</i>	0	2	0
56	336385	6263964	<i>Angophora costata</i>	1	2	0
56	336401	6263966	<i>Angophora costata</i>	1	3	2
56	336409	6263948	<i>Angophora costata</i>	1	0	1

MGA Zone	East	North	Species	Small Hollow	Medium Hollow	Large Hollow
56	336415	6263980	<i>Angophora costata</i>	2	0	0
56	336417	6263977	<i>Eucalyptus umbra</i>	0	1	0
56	336420	6264029	<i>Angophora costata</i>	3	0	1
56	336422	6263950	<i>Angophora costata</i>	0	1	1
56	336425	6264027	<i>Angophora costata</i>	1	0	2
56	336432	6264011	<i>Angophora costata</i>	0	2	1
56	336437	6264000	<i>Angophora costata</i>	0	1	1
56	336444	6264079	<i>Angophora costata</i>	1	0	0
56	336450	6264044	<i>Angophora costata</i>	1	0	0
56	336460	6264075	<i>Angophora costata</i>	1	1	1
56	336460	6264139	<i>Angophora costata</i>	1	0	0
56	336465	6264026	<i>Angophora costata</i>	1	1	1
56	336476	6264160	<i>Angophora costata</i>	1	0	0
56	336478	6264111	<i>Eucalyptus umbra</i>	0	0	1



# Appendix 3

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Threatened flora and fauna species with the potential to occur in the study area





Note: List of threatened species, populations, or ecological communities with potential to occur, which may be affected directly or indirectly by the project is derived from searches of the following databases as well as the on ground survey conducted on Northern Beaches Hospital Project: Likelihood of occurrence is based on the risk matrix in Appendix 4.

1. NSW Office of Environment and Heritage (OEH) Atlas of NSW Wildlife Database and Threatened Species Profiles (2013).
2. Protected Matters Report that documents all Matters of National Environmental Significance (NES) within 10 km of site (Department of Sustainability, Environment, Water, Population and Communities).
3. NSW Flora Online Search – Rare or Threatened Australian Plants (ROTAP) species (The Royal Botanic Gardens and Domain Trust 2011)

**Table 16 Threatened species with potential to occur and assessment of likelihood of occurrence**

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<b>Threatened Ecological Communities</b>						
Blue Gum High Forest of the Sydney Basin Bioregion	CE	CE	Tall forest typically grows in high rainfall areas, receiving more than 1100 mm per year and on deep clay soils derived from Wianamatta Shale. It occurs at elevations of 50–178 m above sea level with gentle slopes.	-	No	Habitat not suitable – occurrence of laterite in weathered clay. Risk Low: unlikely to occur
Duffys Forest Ecological Community	E		Structural form of open forest or woodland. Typically associated with shale lenses and lateritic soils on Hawkesbury Sandstone, which are usually found on ridgetops, plateaus and upperslopes.	-	No	High risk: occurs on study area. Plateau with shale lenses and lateritic soils on Hawkesbury Sandstone. <b>Further assessment required</b>
Eastern Suburbs Banksia Scrub of the Sydney Region	E	E	Structural form of sclerophyllous heath or scrub occasionally with small areas of woodland, forest or wetland vegetation on nutrient poor sand deposits.	-	No	Habitat not suitable –not on nutrient poor sand deposits. Risk Low: unlikely to occur

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	CE	CE	A complex of rainforest and coastal vine thickets, including some that are deciduous. Occurs within two kilometres of the coast or adjacent to a large salt water body on a range of landforms derived from coastal processes in warm temperate, sub-tropical or tropical climatic zones.	-	No	Habitat not suitable - landforms not derived from coastal processes. Risk Low: unlikely to occur
Turpentine-Ironbark Forest in the Sydney Basin Bioregion	CE	CE	A transitional community, between Cumberland Plain Woodland in drier areas and Blue Gum High Forest on adjacent higher rainfall ridges. Occurs in moderately wet areas, with annual rainfall of 800-1100 mm/year, on shale ridge caps and sandstone plateaux. Clay soils derived from Wianamatta Shale. Occurs on relatively high fertility soils.	-	No	Habitat not suitable – occurrence of laterite in weathered clay. Risk Low: unlikely to occur
<b>Threatened Flora</b>						
<i>Acacia bynoeana</i> (Bynoe's Wattle)	EI,P	V	Occurs mainly in heath and dry sclerophyll forest, open woodland with dense to sparse heath understorey; open woodlands with a sparse shrub cover and a grass/sedge ground cover; and heathlands with sparse overstorey. With sand or sandy clay substrate, often with ironstone gravel and usually well drained, infertile soil.	19	No	Habitat not suitable - patches with trace ironstone gravels. No heath or sand or sandy clay. Risk Low: unlikely to occur
<i>Acacia terminalis</i> subsp. <i>terminalis</i> (Sunshine Wattle)	EI,P	E	Habitat requirements include open coastal eucalypt woodland or forest, usually in sandy soil on creek banks, hill-slopes or in shallow soil in rock crevices and sandstone platforms on cliffs.	197	No	Habitat not suitable – soil not shallow sandy. Risk Low: unlikely to occur

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Allocasuarina portuensis</i> (Nielsen Park She-oak)	EI,P	E	This species has only been recorded from Nielsen Park, within Sydney Harbour NP. Occurs on the slope of a sandstone headland, with shallow sandy soils that are highly siliceous, coarsely textured and devoid of a soil profile	32	No	Habitat not suitable - soils not coarse sand. Risk Low: unlikely to occur
<i>Asterolasia elegans</i>		E	Occurs in the northern hills of Sydney. Habitat requirements are wet, sheltered sclerophyll forests on the mid to lower slopes of moist gullies and rocky outcrops.	0	No	Habitat not suitable – no moist gullies or rocky outcrops on the study area. Risk Low: unlikely to occur
<i>Caladenia tessellata</i> (Thick Lip Spider Orchid)	EI,P	V	Requires low, dry sclerophyll woodland with a heathy or sometimes grassy understorey on clay loams or sandy soils, specifically in dry, low Brittle Gum ( <i>Eucalyptus mannifera</i> ), Inland Scribbly Gum ( <i>E. rossii</i> ) and <i>Allocasuarina</i> spp. woodland with a sparse understorey and stony soil.	5	No	Habitat not suitable – no Brittle Gum or Inland Scribbly Gum on site. Risk Low: unlikely to occur
<i>Callistemon linearifolius</i> (Netted Bottle Brush)	V,P		Inhabits dry sclerophyll forest on the coast and adjacent ranges.	14	No	1 record adjacent to site. Habitat requirements very broad. Potential habitat may occur in the study area. Risk Medium: could possibly occur. <b>Further assessment required</b>

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Camarophyllopsis kearneyi</i>	EI,P		Small, gilled fungus, only known to occur in the Lane Cove Bushland Park.	1	No	Known only from Lane Cove Bushland Park Risk Low: unlikely to occur
<i>Chamaesyce psammogeton</i> (Sand Spurge)	EI,P		Coastal distribution and occurs across unstable sands of the strandline zone of coastal foredunes and exposed headlands.	7	No	Habitat not suitable. No coastal dunes or headlands in or near study area. Risk Low: unlikely to occur
<i>Cryptostylis hunteriana</i> (Leafless Tongue Orchid)	V,P	V	Occurs across a wide variety of habitats including coastal districts, heathlands, heathy woodlands, sedgelands, forests, and Spear Grass-tree ( <i>Xanthorrhoea resinosa</i> ) plains. Soils are generally considered to be moist and sandy, however, this species is also known to grow in dry soils and peaty soils	1	No	One record within 10 km of study area. Habitat not suitable – no sandy soil on site. Risk Low: unlikely to occur
<i>Darwinia biflora</i>	V,P	V	Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone. Occurs in Sydney Sandstone Ridgetop Woodland, often on rock shelves.  Associated overstorey species include <i>Eucalyptus haemastoma</i> , <i>Corymbia gummifera</i> and/or <i>E. squamosa</i> . The vegetation structure is usually woodland, open forest or scrub-heath.	104	No	Habitat not suitable – not Sydney Sandstone Ridgetop Woodland Risk Low: unlikely to occur

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Deyeuxia appressa</i>	EI,P	E	Occurs in wet ground in Hornsby area.	3	No	Extremely rare – not recorded in study area since early 1940s. Risk Low: unlikely to occur
<i>Diuris bracteata</i>	EI,P		Occurs in dry sclerophyll woodland.	1	No	Although potential habitat may occur in study area. Only one record within 10 km of study area. Risk Low: unlikely to occur
<i>Epacris purpurascens</i> var. <i>purpurascens</i>	V,P		Occurs in a range of habitat types, most of which have a strong shale soil influence. These include ridgetop drainage depressions supporting wet heath within or adjoining shale cap communities.	59	No	Potential habitat occurs on site in shale cap community. Risk Medium: could possibly occur. <b>Further assessment required</b>
<i>Eucalyptus camfieldii</i> (Camfield's Stringybark)	V,P	V	Occurs mostly in small scattered stands in exposed situations on sandstone plateaus, ridges and slopes near the coast, often on the boundary of tall coastal heaths or low open woodland. Requires shallow sandy soils.	70	No	Habitat not suitable – soil not shallow sandy. Risk Low: unlikely to occur

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Eucalyptus nicholii</i> (Narrow-leaved Black Peppermint)	V,P		Occurs in grassy sclerophyll woodland in association with other eucalyptus species.	11	No	Outside range of natural distribution.- northern NSW (Planted as street tree in the Sydney Metropolitan area) Risk Low: unlikely to occur
<i>Eucalyptus scoparia</i> (Wallangarra White Gum)	EI,P	V	Low altitude populations (below 1300 m) mainly occur in podsolic soils in damp habitat.	1	No	1 record within 10 km of study area. Outside range of natural distribution- northern NSW. Risk Low: unlikely to occur
<i>Genoplesium baueri</i> (Bauer's Midge Orchid)	V,P		Occurs in coastal areas. Habitats include heathland, open forest, shrubby forest, heathy forest and woodland with sandy/sandy loam and well draining soils.	10	No	Habitat not suitable – soil not sandy well drained. Risk Low: unlikely to occur
<i>Grammitis stenophylla</i> (Narrow-leaf Finger Fern)	EI,P		Grows on basalt, conglomerate, granite and sandstone substrate and rocks in rainforest and in wet sclerophyll forest.	4	No	Habitat not suitable – rainforest or in wet sclerophyll forest not likely on the study area. Risk Low: unlikely to occur

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Grevillea caleyi</i> (Caley's Grevillea)	EI,P	E	Occurs on laterite soils in open forests or low open forests, generally dominated by <i>Eucalyptus sieberi</i> and <i>E. gummifera</i> .	211	No	1 record within 100 m of study area. Risk High: Known to occur in Duffys Forest EC. <b>Further assessment required</b>
<i>Haloragodendron lucasii</i>	EI,P	E	Occurs in Hawkesbury Sandstone in moist sandy loam soil in sheltered aspects and on gentle slopes below cliff lines near creeks. Associated with low open woodland with associated vegetation.	33	No	Habitat not suitable –sandy loam soil not on study area. Risk Low: unlikely to occur
<i>Hibbertia puberula</i>	EI,P		Recorded from sandy soils, often associated with sandstone mainly from coastal areas.	1	No	Habitat not suitable –sandy soil not on study area. Risk Low: unlikely to occur
<i>Hibbertia superans</i>	EI,P		Occurs in sandstone ridgetop woodlands, in or near shale/sandstone boundary, often associated with other threatened flora including <i>Pimelea curviflora</i> var. <i>curviflora</i> , <i>Darwinia biflora</i> , <i>Epacris purpurascens</i> var. <i>purpurascens</i> , <i>Leucopogon fletcheri</i> subsp. <i>fletcheri</i> , <i>Acacia bynoeana</i> , <i>Eucalyptus</i> sp. <i>Cattai</i> and <i>Persoonia hirsuta</i> .	1	No	Habitat not suitable – sandstone ridgetop not on study area. Risk Low: unlikely to occur

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Hygrocybe anomala</i> var. <i>ianthinomarginata</i> (Agaric fungus)	V,P		Occurs in the Lane Cove Bushland Park, Royal and Blue Mountains National Parks, with a preference for warm temperate rainforest and wet sclerophyll forest.	1	No	Habitat not suitable – rainforest or in wet sclerophyll forest not likely on the study area. Risk Low: unlikely to occur
<i>Hygrocybe aurantipes</i> (Agaric fungus)	V,P		Occurs in Lane cove Bushland Park, Blue Mountains National Park (Mt Wilson) and Hazelbrook, with a preference for leaf litter and mossy creek banks under closed canopy.	1	No	Habitat not suitable – rainforest or in wet sclerophyll forest not likely on the study area. Risk Low: unlikely to occur
<i>Hygrocybe austropratensis</i> (Agaric fungus)	EI,P		NSW population only know to occur in the Lane Cove Bushland Park. Habitat includes leaf litter and mossy areas in dry forest, particularly in association with <i>Kunzea ericoides</i> .	1	No	Habitat not suitable – rainforest or in wet sclerophyll forest not likely on the study area. Risk Low: unlikely to occur
<i>Hygrocybe collucera</i> (Agaric fungus)	EI,P		NSW population only know to occur in the Lane Cove Bushland Park. Habitat preference for warm-temperate wet-sclerophyll forest.	1	No	Habitat not suitable – rainforest or in wet sclerophyll forest not likely on the study area. Risk Low: unlikely to occur



Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Hygrocybe griseoramosa</i> (Agaric fungus)	EI,P		NSW population only know to occur in the Lane Cove Bushland Park. Habitat preference for warm-temperate wet-sclerophyll forest.	1	No	Habitat not suitable – rainforest or in wet sclerophyll forest not likely on the study area. Risk Low: unlikely to occur
<i>Hygrocybe lanecovensisi</i> (Agaric fungus)	EI,P		NSW population only know to occur in the Lane Cove Bushland Park. Habitat preference for warm-temperate wet-sclerophyll forest.	1	No	Habitat not suitable – rainforest or in wet sclerophyll forest not likely on the study area. Risk Low: unlikely to occur
<i>Hygrocybe reesia</i> (Agaric fungus)	V,P		Occurs in Lane cove Bushland Park and Blue Mountains National Park (Hazelbrook area), with a preference for leaf litter under a closed canopy.	1	No	Habitat not suitable – rainforest or in wet sclerophyll forest not likely on the study area. Risk Low: unlikely to occur
<i>Hygrocybe rubronivea</i> (Agaric fungus)	V,P		NSW population only know to occur in the Lane Cove Bushland Park. Habitat preference for warm-temperate wet-sclerophyll forest.	1	No	Habitat not suitable – rainforest or in wet sclerophyll forest not likely on the study area. Risk Low: unlikely to occur
<i>Kunzea rupestris</i>		V	Occurs in shallow, sandy, low nutrient soil in depressions on sandstone rock platforms. It is typically found in short to tall shrubland or heathland at altitudes of 50–300 m	0	No	Habitat not suitable – soil not shallow sandy. Risk Low: unlikely to occur

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Lasiopetalum joyceae</i>	V,P	V	Grows in heath on sandstone, on lateritic to shaley ridgetops.	6	No	Habitat not suitable – heath not present on site Risk Low: unlikely to occur
<i>Leptospermum deanei</i>	V,P	V	Grows in sandy alluvial soils and sand over sandstone on lower hill slopes and riparian zones. Associated vegetation communities include riparian shrubland, woodland and open forest.	7	No	Habitat not suitable – no sandy alluvium or riparian zones on the study area. Risk Low: unlikely to occur
<i>Macadamia tetraphylla</i> (Rough-shelled Bush Nut)	V,P		Occurs in subtropical rainforest and complex notophyll vineforest, at the margins of these forests and in mixed sclerophyll forest. Grows on moderate to steep hillslopes on alluvial soils at well-drained sites	1	No	Habitat not suitable – rainforest or in wet sclerophyll forest not likely on the study area. Risk Low: unlikely to occur
<i>Melaleuca biconvexa</i> (Biconvex Paperbark)	V,P	V	The species may occur in dense stands forming a narrow strip adjacent to watercourses, in association with other <i>Melaleuca</i> species or as an understorey species in wet forest.	1	No	Habitat not suitable – no watercourse on the study area. Risk Low: unlikely to occur
<i>Melaleuca deanei</i> (Deane's Paperbark)	V,P	V	Endemic to Sydney Basin region and grows in heath on sandstone or flat broad ridge tops. Strongly associated with sandy loam soils that are low in nutrients, sometimes with ironstone present	27	No	Habitat not suitable – sandstone ridgetop with sandy loam soil not on study area. Risk Low: unlikely to occur

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Microtis angusii</i> (Angus's Onion Orchid)	EI,P	E	One known population (Ingleside) Warringah/Pittwater area in the north of Sydney –in highly disturbed site associated with DFEC soil types (shale cap ridge top with lateritic nodules & laminate over Hawkesbury Sandstone)	4	No	One known population (Ingleside) Warringah/Pittwater area - Risk High: likely to occur in Duffys Forest EC. <b>Further assessment required</b>
<i>Persoonia hirsuta</i> (Hairy Geebung)	EI,P	E	Occurs in shrub-woodlands and dry sclerophyll forest. It grows in sandy to stony soils derived from sandstone or very rarely on shale, from near sea level to 600 m altitude.	34	No	Risk High: Known to occur in Duffys Forest EC. <b>Further assessment required</b>
<i>Persoonia laxa</i>	E4,P		Occurs in heath or dry sclerophyll eucalypt woodland, or forest on sandstone, or in coastal sand	1	No	Habitat not suitable –no sandy soil on study area. Risk Low: unlikely to occur
<i>Persoonia mollis</i> subsp. <i>maxima</i>	EI,P		Occurs in deep gullies or on the steep upper hillsides of narrow gullies incised from Triassic Hawkesbury sandstone. Habitat is characterised by sheltered aspects which support relatively moist, tall forest vegetation communities.	80	No	Habitat not suitable –no steep hillsides of narrow gullies incised in Hawkesbury sandstone on study area. Risk Low: unlikely to occur

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Pimelea curviflora</i> var. <i>curviflora</i>	V,P	V	Occurs in open forest on sandy soil derived from sandstone and on lateritic soils. Often grows amongst dense grasses and sedges.	50	No	One known population approximately 1 km from the study area near Allambie Road. Potential habitat occurs on the study area with open forest on sandy soil derived from sandstone and on lateritic soils and shale-sandstone transition soils on ridge tops. Risk High: likely to occur. <b>Further assessment required</b>
<i>Pimelea spicata</i>		E	Occurs on an undulating topography of substrates derived from Wianamatta Shale and Cumberland Plain Woodland Vegetation Community.	0	No	No records within 10 km of the study area. Occurs on an undulating topography of substrates derived from Wianamatta Shale and Cumberland Plain Woodland Vegetation Community. Risk Low: unlikely to occur

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Prostanthera junonis</i> (Somersby Mintbush)	EI,P		Restricted to Sydney Basin bioregion. Preference for sloping habitat, rock outcropping and/or rocky fragments in Open-forest/Low woodland/Open scrub habitat.	3	No	Habitat not suitable –no outcropping rock on study area. Risk Low: unlikely to occur
<i>Prostanthera marifolia</i> (Seaforth Mintbush)	CE,P	CE	Located on deeply weathered clay-loam soils associated with ironstone and scattered shale lenses and occurs in woodland dominated by <i>Eucalyptus sieberi</i> (Black Ash) and <i>Corymbia gummifera</i> (Bloodwood) in or close to Duffys Forest Ecological Community (DFEC).	28	No	Potential habitat occurs on site. Risk High: likely to occur. <b>Further assessment required</b>
<i>Sarcochilus hartmannii</i> (Hartman's Sarcochilus)	V,P		It grows on volcanic rocks, shallow soils and exposed cliffs in sclerophyll forests, rainforest margins or open areas at 500–1000 m altitude.	1	No	Habitat unlikely to occur on the study area. Risk Low: unlikely to occur
<i>Senecio spathulatus</i> (Coast Groundsel)	EI,P		A specialised coastal species occurring mostly on frontal dunes and forming low, broad clumps.	1	No	Habitat unlikely to occur on the study area. Risk Low: unlikely to occur
<i>Syzygium paniculatum</i> (Magenta Lilly Pilly)	EI,P		Grows in subtropical and littoral rainforest on sandy soils or stabilized dunes near the sea.	33	No	Habitat unlikely to occur on the study area. Risk Low: unlikely to occur

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Tetratheca glandulosa</i> (Glandular Pink-bell)	V,P	V	Strongly associated with areas of shale-sandstone transition habitat and occupies ridgetops, upper-slopes and mid-slope sandstone benches. Preferred vegetation includes heaths, scrub, woodlands/open woodlands and open forest.	267	No	Potential habitat occurs on site with weathered clay-loam soils associated with ironstone and scattered shale lenses.  Risk High: likely to occur. <b>Further assessment required</b>
<i>Thesium australe</i> (Austral Toadflax, Toadflax)		V	Suitable habitat for this species includes grassland and grassy woodland, often in damp sites.	0	No	Not recorded within 10 km of study area.  Potential habitat (grassland and grassy woodland) unlikely to occur on the study area.  Risk Low: unlikely to occur
<b>Threatened Fauna (Birds)</b>						
<i>Anthochaera phrygia</i> (Regent Honeyeater)	E4A,P	E	NSW the distribution is very patchy and mainly confined to the two main breeding areas at Capertee Valley and the Bundarra-Barraba region and surrounding fragmented woodlands. The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-oak.	0 / 19	No	Risk Extremely Low: extremely unlikely to occur

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Ardenna carneipes</i> (Flesh-footed Shearwater)	V,P	M	Migratory species common to southern Australian waters of continental shelf/slope. Utilise island breeding burrows on sloping ground in coastal forest, scrubland, shrubland or grassland.	0 / 3	No	Risk Extremely Low: extremely unlikely to occur
<i>Botaurus poiciloptilus</i> (Australasian Bittern)	EI,P	E	Inhabits temperate freshwater wetlands and occasionally estuarine reedbeds, with a preference for permanent waterbodies with tall dense vegetation.	0 / 3	No	Risk Extremely Low: extremely unlikely to occur
<i>Burhinus grallarius</i> (Bush Stone-curlew)	EI,P		The current NSW distribution is patchy and scattered, with sporadic distribution around Sydney. In coastal areas typically found in lower elevation grassy woodland and open forest, with broad ground and understorey structural features.	0 / 7	No	Habitat resources available on site. Risk Medium: could possibly occur <b>Further assessment required</b>
<i>Calidris alba</i> (Sanderling)	V,P	M	Coastal migratory species with a NSW distribution from Hastings Point to Shoalhaven Heads. Found in open, sandy beaches with exposed sand bars and rocky outcrops. Rare use of near-coastal wetlands.	0 / 7	No	Risk Extremely Low: extremely unlikely to occur
<i>Calidris ferruginea</i> (Curlew Sandpiper)	EI,P	M	Migratory shorebird distributed along entire coast of NSW. Occur on intertidal mudflats in sheltered coastal area	0 / 7	No	Risk Extremely Low: extremely unlikely to occur
<i>Calidris tenuirostris</i> (Great Knot)	V,P	M	Migratory seabird, occurs within sheltered, coastal habitats containing large, intertidal mudflats or sandflats.	0 / 4	No	Risk Extremely Low: extremely unlikely to occur

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Callocephalon fimbriatum</i> (Gang-gang Cockatoo pops Hornsby, Ku-ring-gai LGAs)	E2,V,P		Gang-gang Cockatoos were once widespread and numerous in Sydney and surrounding areas, but have been greatly reduced in recent years by loss of habitat. A population persists in the Hornsby and Ku-ring-gai Local Government Areas and nest in hollows in large, old trees.	0 / 6	No	Risk Low: unlikely to occur
<i>Callocephalon fimbriatum</i> (Gang-gang Cockatoo)	V,P		Occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests in winter and open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas in summer.	0 / 8	No	Habitat and foraging resources available on site. Risk Medium: could possibly occur <b>Further assessment required</b>
<i>Calyptorhynchus lathamii</i> (Glossy Black-Cockatoo)	V,P		Occupy coastal woodlands and drier forest areas, open inland woodlands or timbered watercourses where casuarina are present	0 / 92	No	Habitat and foraging resources available on site. Risk Medium: could possibly occur <b>Further assessment required</b>
<i>Charadrius leschenaultii</i> (Greater Sand-plover)	V,P	M	Occurs in coastal areas and inhabits littoral and eustarine habitats. Prefer sheltered sandy, shelly or muddy beaches with large intertidal mudflats or sandbanks.	0 / 1	No	Risk Extremely Low: extremely unlikely to occur



Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Charadrius mongolus</i> (Lesser Sand-plover)	V,P	M	Occur along the Australian coastline with highest abundance north of Shoalhaven estuary. Habitat preferences for beaches, mudflats and mangroves.	0 / 1	No	Risk Extremely Low: extremely unlikely to occur
<i>Daphoenositta chrysoptera</i> (Varied Sittella)	V,P		Inhabits most of mainland Australia except the treeless deserts and open grasslands. It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and <i>Acacia</i> woodland.	0 / 3	No	Foraging and habitat resources available on site. Risk Medium: could possibly occur <b>Further assessment required</b>
<i>Diomedea exulans</i> (Wandering Albatross)	E1,P	V, M	Migratory marine species. Island breeding sites located on coastal/inland ridges with open, patchy vegetations and grass tussocks.	0 / 10	No	Risk Extremely Low: extremely unlikely to occur
<i>Ephippiorhynchus asiaticus</i> (Black-necked Stork)	E1,P		Restricted to coastal and near-coastal habitat. Inhabits wetlands, floodplains and deeper permanent water bodies.	0 / 1	No	Risk Extremely Low: extremely unlikely to occur
<i>Esacus magnirostris</i> (Beach Stone-curlew)	E4A,P		Inhabits undisturbed beaches, islands, reefs and estuarine intertidal sand and mudflats.	0 / 1	No	Risk Extremely Low: extremely unlikely to occur
<i>Eudyptula minor</i> (Little Penguin in the Manly Area)	E2,P		The Little Penguin population at North Sydney Harbour nests in rock falls and rocky shorelines.	0 / 4	No	Risk Extremely Low: extremely unlikely to occur

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Glossopsitta pusilla</i> (Little Lorikeet)	V,P		Mostly occur in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes.	0 / 7	No	Foraging, habitat and nesting resources available on site. Risk Medium: could possibly occur <b>Further assessment required</b>
<i>Gygis alba</i> (White Tern)	V,P		Pelagic, migratory marine species. Require tall coastal forest for nesting sites.	0 / 1	No	Risk Extremely Low: extremely unlikely to occur
<i>Haematopus fuliginosus</i> (Sooty Oystercatcher)	V,P		Occurs on rocky shorelines and headlands, stony beaches, offshore islands and exposed reefs and only occasionally on sandy beaches.	0 / 22	No	Risk Extremely Low: extremely unlikely to occur
<i>Haematopus longirostris</i> (Pied Oystercatcher)	EI,P		Inhabits marine littoral habitats, including islands. It occupies muddy, sandy, stony or rocky estuaries, inlets and beaches, particularly intertidal mudflats and sandbanks in large marine bays.	0 / 6	No	Risk Extremely Low: extremely unlikely to occur
<i>Hieraaetus morphnoides</i> (Little Eagle)	V,P		Distributed throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. Occupies habitats rich in prey within open eucalypt forest, woodland or open woodland.	0 / 5	No	Foraging and habitat resources available on site. Risk Medium: could possibly occur <b>Further assessment required</b>

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Ixobrychus flavicollis</i> (Black Bittern)	V,P		Occurs below 200 m above sea level and inhabit both terrestrial and estuarine wetlands, with a preference for permanent water bodies and dense vegetation.	0 / 16	No	Risk Extremely Low: extremely unlikely to occur
<i>Lathamus discolor</i> (Swift Parrot)	EI,P	E	In NSW mostly occurs on the coast and south west slopes, occurring 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 <i>Eucalyptus robusta</i> , Spotted Gum <i>Corymbia maculata</i> , Red Bloodwood <i>C. gummifera</i> , Mugga Ironbark <i>E. sideroxylon</i> , and White Box <i>E. albens</i> .	0 / 17	No	Some foraging resources available on site. Risk Medium: could possibly occur <b>Further assessment required</b>
<i>Limicola falcinellus</i> (Broad-billed Sandpiper)	V,P		Migratory species. Favour estuarine mudflats, saltmarshes and reefs as feeding and roosting habitat throughout Australian distribution.	0 / 2	No	Risk Extremely Low: extremely unlikely to occur
<i>Macronectes giganteus</i> (Southern Giant Petrel)	EI,P	E, M	Migratory marine bird distributed from Antarctic to subtropical waters and nests on offshore and Antarctic islands.	0 / 15	No	Risk Extremely Low: extremely unlikely to occur
<i>Macronectes halli</i> (Northern Giant Petrel)	V,P	V, M	Circumpolar pelagic distribution with breeding on Australian offshore islands. Nest in secluded, sheltered coastal habitat with dense vegetation.	0 / 3	No	Risk Extremely Low: extremely unlikely to occur
<i>Nettion coromandelianus</i> (Cotton Pygmy-Goose)	EI,P		Aquatic species that inhabits deep freshwater lagoons, swamps and dams, particularly those with waterlilies or other floating vegetation.	0 / 4	No	Risk Extremely Low: extremely unlikely to occur

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Ninox connivens</i> (Barking Owl)	V,P		Occurs throughout NSW, where it inhabits dry open sclerophyll forests and woodlands, favouring dense riparian stands of eucalypts or casuarinas along watercourses or around wetlands, where there are many large trees suitable for roosting or breeding.	0 / 9	No	Foraging resources available on site. Risk High: Highly likely to occur <b>Further assessment required</b>
<i>Ninox strenua</i> (Powerful Owl)	V,P		Is endemic to eastern and south-eastern Australia, being widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered, mostly historical records on the western slopes and plains in NSW. Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. They require large tracts of forest or woodland habitat but can occur in fragmented landscapes as well.	3 / 185	No	Foraging and nesting resources available on site. Risk High: Highly likely to occur <b>Further assessment required</b>
<i>Onychoprion fuscata</i> (Sooty Tern)	V,P		The Sooty Tern is a pelagic species that forages offshore. Breeding colonies habitat requirements during nesting include coral cays, atolls, sandbanks, rock stacks, cliffs or other offshore islets.	0 / 3	No	Risk Extremely Low: extremely unlikely to occur
<i>Pandion cristatus</i> (Eastern Osprey)	V,P	M	Requires clear estuarine and inshore marine waters and coastal rivers for foraging, and nests in tall (usually dead or dead-topped) trees in coastal habitats from open woodland to open forest, within 1-2 km of water.	0 / 12	No	Risk Extremely Low: extremely unlikely to occur

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Petroica boodang</i> (Scarlet Robin)	V,P		In NSW it occupies open forests and woodlands from the coast to the inland slopes. Breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within an open understorey of shrubs and grasses and sometimes in open areas. Abundant logs and coarse woody debris are important structural components of its habitat.	0 / 2	No	Foraging and nesting habitat available on site. Risk Medium: could possibly occur <b>Further assessment required</b>
<i>Phoebastria fusca</i> (Sooty Albatross)	V,P	V, M	Pelagic migratory species, breeding habitat and nesting typically on small, isolated subantarctic Islands.	0 / 1	No	Risk Extremely Low: extremely unlikely to occur
<i>Pterodroma leucoptera leucoptera</i> (Gould's Petrel)	V,P	E, M	Pelagic marine species, spending much of its time foraging at sea and coming ashore only to breed, with nesting sites at 2 islands of NSW.	0 / 2	No	Risk Extremely Low: extremely unlikely to occur
<i>Ptilinopus magnificus</i> (Wompoo Fruit-Dove)	V,P		Typically occurs in patches of subtropical rainforest and adjoining wet sclerophyll habitats, with a preference for warmer, mature rainforests dominated by <i>Ficus</i> spp.	0 / 2	No	Risk Extremely Low: extremely unlikely to occur
<i>Ptilinopus superbus</i> (Superb Fruit Dove)	V,P		Inhabits rainforests and similar closed forest at all altitudes.	0 / 16	No	Risk Extremely Low: extremely unlikely to occur
<i>Puffinus assimilis</i> (Little Shearwater)	V,P		Pelagic seabird that feeds in continental shelf waters and breed on the subtropical and sub-Antarctic islands, where the soil is soft and suitable for burrowing.	0 / 2	No	Risk extremely Low: extremely unlikely to occur

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Stagonopleura guttata</i> (Diamond Firetail)	V,P		Found in grassy eucalypt woodlands, open forest, mallee, grassland and riparian areas.	0 / 1	No	Foraging and roosting resources available on site. Risk Medium: could possibly occur <b>Further assessment required</b>
<i>Sternula albifrons</i> (Little Tern)	EI,P		Exclusively coastal species requiring estuarine and coastal beaches for nesting and feeding. Prefer open habitat with access to vegetation to provide shelter for young.	0 / 2	No	Risk Extremely Low: extremely unlikely to occur
<i>Thalassarche cauta</i> (Shy Albatross)	V,P	V, M	Marine species occurring in subantarctic and subtropical waters, reaching the tropics off South America.	0 / 6	No	Risk Extremely Low: extremely unlikely to occur
<i>Thalassarche melanophris</i> (Black-browed Albatross)	V,P	V, M	Circumpolar distribution and inhabits antarctic, subantarctic and subtropical marine waters.	0 / 7	No	Risk Extremely Low: extremely unlikely to occur
<i>Tyto novaehollandiae</i> (Masked Owl)	V,P		Occurs throughout NSW, roosting and nesting in heavy forest. Hunts over open woodland and farmland. The main requirements are tall trees with suitable hollows for nesting and roosting and adjacent areas for foraging.	0 / 3	No	Foraging resources available on site. Risk High: Highly likely to occur <b>Further assessment required</b>

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Tyto tenebricosa</i> (Sooty Owl)	V,P		Inhabits subtropical and warm temperate rainforest, and moist eucalypt forest with a well-developed mid-storey of trees or shrubs. Roost and nest sites for the species occur in gullies. Utilise hollows for nesting and prey on other hollow dependent species.	0 / 1	No	Foraging resources available on site. Risk High: Highly likely to occur <b>Further assessment required</b>
<b>Threatened Fauna (Mammals)</b>						
<i>Cercartetus nanus</i> (Eastern Pygmy-possum)	V,P		In New South Wales the species is found in coastal areas and at higher elevation. Inhabit shrubby vegetation in a wide variety of habitats, from open heathland or shrubland to sclerophyll or rain forest. Require flowering plants and shrubs for foraging and access to hollows/nesting vegetation.	0 / 47	Yes	Foraging and nesting resources available on site. Risk High: Highly likely to occur <b>Further assessment required</b>
<i>Chalinolobus dwyeri</i> (Large-eared Pied Bat)	V,P	V	Require extensive cliffs and caves with adjacent higher fertility sites, particularly box gum woodlands or river/rainforest corridors. Found in sandy escarpments in the Sydney basin, Distribution from Rockhampton in Queensland through to Ulladulla, NSW in the south.	0 / 1	No	Risk Low: unlikely to occur

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Dasyurus maculatus</i> (Spotted-tailed quoll)	V,P	E	It is found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland. Uses 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 crevices, boulder fields and rocky-cliff faces as den sites.	0 / 31	No	Foraging resources available on site. Risk Medium: could possibly occur <b>Further assessment required</b>
<i>Isodon obesulus obesulus</i> (Southern Brown Bandicoot, Eastern)	EI,P	E	NSW distribution almost exclusively restricted to coastal fringe. Habitats including heathland, shrubland, sedgeland, heathy open forest and woodland and are usually associated with infertile, sandy and well drained soils, but can be found in a range of soil types. Within these vegetation communities they typically inhabit areas of dense ground cover.	0 / 325	Yes	Foraging and nesting resources available on site. Risk High: Highly likely to occur <b>Further assessment required</b>
<i>Miniopterus schreibersii oceanensis</i> (Eastern Bentwing-bat)	V,P		Occur along the east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.	0 / 60	No	Foraging habitat available on site. Risk Medium: could possibly occur <b>Further assessment required</b>



Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Mormopterus norfolkensis</i> (Eastern Freetail-bat)	V,P		Habitats preference includes dry eucalypt forest and coastal woodlands but also include riparian zones in rainforest and wet sclerophyll forest. Forages above forest canopy or forest edge and requires roosts including tree hollows.	0 / 6	No	Foraging habitat and some roosting resources available on site. Risk Medium: could possibly occur <b>Further assessment required</b>
<i>Myotis macropus</i> (Southern Myotis)	V,P		Found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. 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.	0 / 3	No	Some potential roosting habitat available on site. Risk Medium: could possibly occur <b>Further assessment required</b>
<i>Perameles nasuta</i> (Long-nosed Bandicoot, North Head)	E2,P		Habitat includes rainforest, wet and dry forest, woodland, heathland, grassland and urban areas. North Head population occupy all of the habitat types available including woodlands, scrub, heath and open areas.	0 / 36	No	Risk Low: unlikely to occur ** Long-nosed bandicoots are highly likely to occur, but not from the North Head population **
<i>Petaurus australis</i> (Yellow-bellied Glider)	V,P		Typically occurs in tall, mature eucalypt forest in regions of high rainfall, but is also known to occur in drier areas. Preference for resource rich forests where mature trees provide nesting hollows and tree species composition with adequate food resources.	0 / 1	Yes	Some foraging and nesting resources available on site. Risk Medium: could possibly occur <b>Further assessment required</b>

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Petrogale penicillata</i> (Brush-tailed Rock Wallaby)		V	Habitats occupied include: loose piles of large boulders containing subterranean holes and passageways; cliffs (usually over 15 m high) with mid-level ledges and with some caves and/or ledges covered by overhangs; and isolated rock stacks, usually sheer-sided and often girdled with fallen boulders.	0 / 0	No	Risk Low: unlikely to occur
<i>Phascolarctos cinereus</i> (Koala in the Pittwater LGA)	E2,V,P		Inhabits a range of eucalypt forest and woodland communities. Adequate floristic diversity, availability of feed trees (primarily <i>Eucalyptus tereticornis</i> and <i>E. viminalis</i> ) and presence of mature trees very important.	0 / 25	No	Risk Low: unlikely to occur
<i>Phascolarctos cinereus</i> (Koala)	V,P	V	Inhabits a range of eucalypt forest and woodland communities. Adequate floristic diversity, availability of feed trees (primarily <i>Eucalyptus tereticornis</i> and <i>E. viminalis</i> ) and presence of mature trees very important.	0 / 44	No	Limited foraging and habitat resources available on site. Risk Medium: could possibly occur <b>Further assessment required</b>

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Pseudomys novaehollandiae</i> (New Holland Mouse)		V	In NSW, the New Holland Mouse is known from Royal National Park (NP) and the Kangaroo Valley; Kuringai Chase NP; and Port Stephens to Evans Head near the Queensland border. Coastal heath vegetation undergoing early to mid-successional regeneration, as a result of habitat disturbances (e.g. fire, mining, clearing) appears to be preferred habitat in many areas.	0 / 0	Yes	Habitat resources available on site. Risk High: Highly likely to occur <b>Further assessment required</b>
<i>Pteropus poliocephalus</i> (Grey-headed Flying-fox)	V,P		Found within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Forages on fruit trees including Figs and nectar trees including Eucalypts and Melaleuca.	0 / 1017	No	Foraging resources available on site. Risk High: Highly likely to occur <b>Further assessment required</b>
<i>Saccolaimus flaviventris</i> (Yellow-bellied Sheath-tail-bat)	V,P		Inhabits eucalypt rainforest, sclerophyll forest and open woodland vegetation. Availability of tree hollows is important for access to roosting sites.	0 / 1	No	Foraging resources and limited roosting resources available on site. Risk Medium: could possibly occur <b>Further assessment required</b>

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Scoteanax rueppellii</i> (Greater Broad-nosed Bat)	V,P		Occur in a variety of habitats including rainforest, dry and wet sclerophyll forest and eucalypt woodland. Large hollow bearing trees required for roosting.	0 / 2	No	Foraging resources and limited roosting resources available on site. Risk Medium: could possibly occur <b>Further assessment required</b>
<b>Threatened Fauna (Reptiles)</b>						
<i>Holocephalus bungaroides</i> (Broad-headed Snake)		V	Confined to the Sydney basin within a radius of approximately 200 km of Sydney. Preferred habitat of sandstone outcrops with woodland, open woodland and/or heath vegetation. Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges and tree hollows.	0 / 0	No	Risk Low: unlikely to occur
<i>Varanus rosenbergi</i> (Rosenberg's Goanna)	V,P		Utilise sandstone outcrops and crevices as important shelter and over wintering habitat. Occurs in sandstone woodlands, heath and upland swamps. Also shelters in hollows, burrows and logs.	0 / 67	No	Foraging and limited shelter resources available on site. Risk Medium: could possibly occur <b>Further assessment required</b>
<b>Threatened Fauna (Frogs)</b>						

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Heleioporus australiacus</i> (Giant Burrowing Frog)	V,P	V	Distributed through the Sydney Basin sandstone country in woodland, open woodland and heath vegetation, breeding habitat is generally soaks or pools within first or second order streams, but also 'hanging swamp' seepage lines and where small pools form from the collected water.	0 / 16	No	Habitat resources available on site. Risk Medium: could possibly occur <b>Further assessment required</b>
<i>Litoria aurea</i> (Green and Golden Bell Frog)	EI,P	V	Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast. It inhabits marshes, dams and stream-sides, particularly those containing bullrushes ( <i>Typha</i> spp.) or spikerushes ( <i>Eleocharis</i> spp.)	0 / 5	No	Risk Extremely Low: extremely unlikely to occur
<i>Litoria littlejohni</i> (Littlejohn's Tree Frog)		V	Restricted to sandstone woodland and heath communities at mid to high altitude. It forages both in the tree canopy and on the ground, and it has been observed sheltering under rocks on high exposed ridges during summer. It is not known from coastal habitats.	0 / 0	No	Risk Low: unlikely to occur
<i>Mixophyes balbus</i> (Stuttering Frog)		V	Inhabits rainforest, Antarctic beech and wet sclerophyll forests. The species depends on freshwater streams and riparian vegetation for breeding and habitation, and do not inhabit disturbed riparian areas.	0 / 0	No	Risk Extremely Low: extremely unlikely to occur

Scientific name (Common name)	TSC Act	EPBC Act	Habitat requirements	Number of records in locality (10 km radius)	Influenced by off-site impacts	Likelihood of occurrence
<i>Pseudophryne australis</i> (Red-crowned Toadlet)	V,P		Confined to the Sydney Basin and north east margin of the South Eastern highlands. Shelters under flat sandstone rocks, either resting on bare rock or damp loamy soils. They have also been found under logs on soil, beneath thick ground litter and in horizontal rock crevices near the ground.	0 / 153	No	Habitat resources available on site. Risk Medium: could possibly occur <b>Further assessment required</b>

Note:E = Endangered; CE = Critically Endangered; V = Vulnerable; P = Protected; M = Migratory

# Appendix 4

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Risk matrix – likelihood of occurrence based on desktop and ground-truthing





	Likelihood of Occurrence based on further investigations e.g. on-ground						
	Descriptions	Species not identified and suitable habitat occurs > 10 km away from the Study area	Species not identified but suitable habitat occurs within 1 km of the Study area	Species not identified and no suitable habitat occurs within the Study area	Species not identified but partially disturbed or degraded habitat occurs within the Study area	Species not identified but suitable habitat occurs within the Study area	Species identified and suitable habitat occurs within the Study area
<b>Likelihood of Occurrence - based on desktop assessments</b>		F	E	D	C	B	A
<b>Expected to occur during the Project or beyond the Project (i.e. recent records exist in high numbers)</b>	A	M	M	H	H	H	H
<b>Could occur during the Project or beyond the Project (i.e. recent records exists)</b>	B	L	M	M	H	H	H
<b>Possible under exceptional circumstances (i.e. recent records exists but low in number)</b>	C	L	L	M	M	H	H
<b>Unlikely to occur during the Project (i.e. old records but low in number)</b>	D	L	L	L	M	M	H
<b>Very unlikely to occur during the Project (i.e. only old records)</b>	E	EL	L	L	L	M	M
<b>Extremely rare or previously unknown to occur (i.e. no records)</b>	F	EL	EL	L	L	L	M

Risk extremely Low (EL): extremely unlikely to occur	Risk Low (L): unlikely to occur	Risk Medium (M): could possibly occur	Risk High (H): Highly likely to occur/does occur
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# Appendix 5

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## EP&A Act assessments of significance



**NOTE:**

The following seven part tests associated with the assessment of significant effect on threatened species, populations or ecological communities, or their habitats have been undertaken in accordance with the requirements of Section 5A of the *Environmental Planning and Assessment Act 1979* ('Act').

These assessments, under Section 5A of the Act, may have been undertaken with prescribed designated mitigation measures that form part of the 'Action Proposed'<sup>1</sup> for the 'Development'<sup>2</sup>. The effect of which is that these mitigation measures become a mandatory obligation based on Consent Authority approval to proceed.

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<sup>1</sup> Action Planned is as detailed in Section 5A of the *Environmental Planning and Assessment Act 1979*

<sup>2</sup> 'Development' has the same meaning as determined under Section 4 of the *Environmental Planning and Assessment Act 1979*

## **Ecological Community: Duffys Forest Ecological Community**

<b>Criterion</b>	<b>(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>
<b>Response</b>	Not applicable
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	Not applicable
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</b> <b>(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</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The study area is predominantly Duffys Forest Ecological Community</li> <li>• Vegetation and habitat removal is extensive and permanent</li> </ul>
<b>Conclusion</b>	The proposed activity 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
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The study area is predominantly Duffys Forest Ecological Community</li> <li>• Vegetation and habitat removal is extensive and permanent</li> </ul>
<b>Conclusion</b>	The proposed activity 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
<b>Criterion</b>	<b>(d) in relation to the habitat of a threatened species, population or ecological community:</b> <b>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Habitat removal is extensive and permanent</li> </ul>
<b>Conclusion</b>	Proposed activity will severely affect habitat of Duffys Forest Ecological Community

<b>Criterion</b>	<b>(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</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>Habitat removal is extensive and permanent</li> <li>Existing wildlife corridors are inadequate to prevent fragmentation/isolation</li> </ul>
<b>Conclusion</b>	Habitat is likely to become fragmented and isolated from other areas of habitat as a result of the proposed action
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>Only 15% of the original area of the Duffys Forest Ecological Community currently exists in the form of a number of remnants</li> <li>Habitat to be removed is in an already fragmented, urbanized area</li> </ul>
<b>Conclusion</b>	The habitat to be removed is important to the long-term survival of DFEC
<b>Criterion</b>	<b>(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).</b>
<b>Response</b>	Not applicable
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>No recovery plan or threat abatement plan has been gazette for DFEC. However, the OEH community profile sets out a number of priority activities to assist this EEC</li> <li>Implement appropriate fire management practices (recommended fire interval of 8-12 years)</li> <li>Prevent and restore erosion and stormwater damage.</li> <li>Restrict and control access to remnants.</li> <li>Prevent further loss and fragmentation of habitat.</li> <li>Protect and restore buffer areas to DFEC remnants.</li> <li>Restore degraded habitat using bush regeneration techniques.</li> </ul>
<b>Conclusion</b>	The proposed activity is not consistent with the priority actions recommended to assist this EEC.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>Land clearing and associated fragmentation identified as a threat to the survival of DFEC.</li> </ul>
<b>Conclusion</b>	The proposed action constitutes the key threatening process 'Clearing of native vegetation'.

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### **Overall Conclusion**

The proposed activity will permanently remove approximately 4.25 ha of remnant vegetation that has been classified as the endangered ecological community Duffys Forest Ecological Community. It is estimated that only 15% of the original distribution of Duffys Forest Ecological Community remains, all in remnants. Duffys Forest Ecological Community occurs primarily in Warringah and Ku-ring-gai Local Government Areas. The removal of DFEC is inconsistent with management priorities to conserve and rehabilitate the ecological community.

Preparation of a Species Impact Statement or appropriate BioBanking offsets is required.

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### **Mitigation Measures**

- Retention of remnant of DFEC on former Blinking Light Reserve land to east of Bantry Bay Road.
  - Management of threats (weed invasion, inappropriate fire regimes and public access to habitat).
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**Species Names: *Microtis angusii* (Angus's Onion Orchid)**

<b>Criterion</b>	<b>(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>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Angus's Onion Orchid is listed as Endangered under the TSC Act and EPBC Act</li> <li>• This orchid species was not found on the site, however is noted to potentially occur in Duffys Forest Ecological Community</li> <li>• Vegetation on the study area is predominantly Duffys Forest Ecological Community (DFEC)</li> <li>• Vegetation and habitat removal is permanent</li> </ul>
<b>Conclusion</b>	The proposed activity is unlikely to have an adverse effect on the life cycle of this species.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	Not applicable
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</b> <b>(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</b>
<b>Response</b>	Not applicable
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	Not applicable
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(d) in relation to the habitat of a threatened species, population or ecological community:</b> <b>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Potential habitat removal is permanent, however no individuals were identified during detailed targeted survey.</li> </ul>
<b>Conclusion</b>	Potential habitat of Angus's Onion Orchid will be removed yet no threatened species were found.

<b>Criterion</b>	<b>(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</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Potential habitat removal is permanent.</li> <li>• Existing fragmented site bound by major roads and removed residential housing.</li> </ul>
<b>Conclusion</b>	No actual habitat has been identified, potential habitat will be removed. No individuals or populations have been identified.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Habitat to be removed is in an already fragmented, urbanized area</li> </ul>
<b>Conclusion</b>	The habitat to be removed is not important to the long-term survival of the Angus's Onion Orchid
<b>Criterion</b>	<b>(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• No critical habitat has been declared for this species</li> </ul>
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.</b>
<b>Response</b>	<p>A national recovery plan has been developed for Angus's Onion Orchid and objectives include:</p> <ul style="list-style-type: none"> <li>• Habitat/population protection and management</li> <li>• Determine habitat requirements and ecological information</li> </ul> <p>The NSW OEH profile for this species sets out five priority actions for this species:</p> <ul style="list-style-type: none"> <li>• Determine and establish the most appropriate ex-situ storage of plant material.</li> <li>• Determine and undertake appropriate fire management of the known population and possible habitat.</li> <li>• Prepare a weed assessment and management strategy for the site.</li> <li>• Undertake yearly monitoring at Ingleside during the flowering season (May - October).</li> <li>• Undertake surveys of potential areas during the flowering season (May - October).</li> </ul>
<b>Conclusion</b>	The proposed activity does not affect any individuals or populations and hence objectives of the recovery plan or priority actions are not relevant.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Potential habitat removal is extensive and permanent, yet no individuals or populations have been identified.</li> </ul>
<b>Conclusion</b>	The proposed action constitutes the key threatening process 'Clearing of native vegetation'.

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### **Overall Conclusion**

No individual species were identified during survey and targeted searches for threatened flora. While the proposed activity will permanently remove approximately 4.25 ha of remnant vegetation that has been classified as the endangered ecological community Duffys Forest Ecological Community, the species is not considered to be present nor affected.

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### **Mitigation Measures**

- Retention of remnant of DFEC on former Blinking Light Reserve land to east of Bantry Bay Road.
  - Management of threats (weed invasion, inappropriate fire regimes and public access to habitat).
  - Offsetting of DFEC.
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**Species Names:** *Callistemon linearifolius* (Netted Bottle Brush), *Epacris purpurascens* var. *purpurascens*, *Grevillea caleyi* (Caley's Grevillea), *Persoonia hirsuta* (Hairy Geebung), *Prostanthera marifolia* (Seaforth Mintbush), *Tetratheca glandulosa* (Glandular Pink-bell)

**Reason for grouping:** *Shrubs species with similar habitat requirements*

<b>Criterion</b>	<b>(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>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The study area is predominantly Duffys Forest Ecological Community.</li> <li>• No species were identified during seasonal surveys and targeted searches.</li> <li>• DFEC on the site may provide potential habitat for these species and its removal is permanent.</li> </ul>
<b>Conclusion</b>	The proposed activity is unlikely to have an adverse effect on the extent of any of these species.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	Not applicable
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</b> <b>(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</b>
<b>Response</b>	Not applicable
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	Not applicable
<b>Conclusion</b>	Not applicable

<b>Criterion</b>	<b>(d) in relation to the habitat of a threatened species, population or ecological community:</b>
	<b>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Potential habitat removal is permanent.</li> <li>• No individuals or populations have been identified on site.</li> </ul>
<b>Conclusion</b>	Proposed activity will remove potential habitat of these species, however no populations or individuals of these species have been recorded on the site.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Habitat to be removed is in an already fragmented, urbanized area.</li> <li>• No individuals or populations have been identified on site.</li> </ul>
<b>Conclusion</b>	Habitat is likely to become fragmented and isolated from other areas of habitat as a result of the proposed action.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Actual habitat to be removed is not considered to support any threatened flora species.</li> </ul>
<b>Conclusion</b>	The habitat to be removed is unlikely to be important to the long-term survival of these species.
<b>Criterion</b>	<b>(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• No critical habitat has been declared for any of these species</li> </ul>
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.</b>
<b>Response</b>	<p>No recovery plan has been developed for Netted Bottle Brush, but thirteen (13) priority actions have been identified to aid in its recovery, including:</p> <ul style="list-style-type: none"> <li>• Conduct management related ecological research</li> <li>• Collection of seeds for NSW Seedbank</li> <li>• Develop threat abatement and monitoring plan</li> </ul> <p>A recovery plan has been developed for Caley's grevillea (March 2004) and twenty-two (22) priority actions have been identified to aid in its recovery, including:</p> <ul style="list-style-type: none"> <li>• Investigate seed viability and collect seed for NSW Seedbank</li> <li>• Install fencing to protect populations</li> <li>• Implement weed control and bush regeneration</li> </ul> <p>No recovery plan has been developed for Seaforth Mintbush, three actions have been identified to aid its recovery, including:</p> <ul style="list-style-type: none"> <li>• Active management of sites to control threats, especially weeds, access and drainage.</li> </ul>

	<ul style="list-style-type: none"> <li>• Implement appropriate fire regime</li> <li>• Liaise with adjacent land managers to ensure management practices avoid or minimise impacts to known populations, including the use of fertilisers and herbicides, access and drainage</li> </ul> <p>No recovery plan has been developed for <i>Epacris purpurascens</i> var. <i>purpurascens</i>, but six (6) priority actions have been identified, including:</p> <ul style="list-style-type: none"> <li>• Understanding the relationship with fire (interval and intensity)</li> <li>• Weed removal, limiting plant pathogens and bush regeneration</li> </ul> <p>No recovery action plan has been developed for Hairy Geebung, but sixteen (21) priority actions have been identified, including:</p> <ul style="list-style-type: none"> <li>• Incorporate best knowledge regarding appropriate fire regime into land management practices</li> <li>• Restrict vehicular and pedestrian access to sites, where necessary</li> <li>• Establish ex-situ seed bank</li> <li>• Identify, map and survey potential habitat</li> </ul> <p>No recovery action plan has been developed for Glandular Pink-bell, but sixteen (16) priority actions have been identified, including:</p> <ul style="list-style-type: none"> <li>• Threat management works (weed control, restrict access, slashing under powerlines)</li> <li>• Establish ex-situ seed bank</li> <li>• Identify, map and survey potential habitat</li> </ul>
<b>Conclusion</b>	No individuals or population have been identified on the site. The objectives of recovery or threat abatement plans/or priority actions identified are not applicable.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Potential habitat removal is permanent</li> </ul>
<b>Conclusion</b>	The proposed action constitutes the key threatening process 'Clearing of native vegetation', however no individuals or populations have been identified as being threatened by the proposal.

### Overall Conclusion

No individual species were identified during survey and targeted searches for threatened flora. While the proposed activity will permanently remove approximately 4.25 ha of remnant vegetation that has been classified as the endangered ecological community Duffys Forest Ecological Community, the species is not considered to be present nor affected.

### Mitigation Measures

- Retention of remnant of DFEC on former Blinking Light Reserve land east of Bantry Bay Road.
- Management of threats (weed invasion, inappropriate fire regimes, Phytophthora, and public access to habitat).
- Offsetting of DFEC.

**Species Name: *Isoodon obesulus* (Southern Brown Bandicoot)**

<b>Criterion</b>	<b>(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>
<b>Response</b>	<ul style="list-style-type: none"> <li>• This species is listed as 'Endangered' under the TSC Act.</li> <li>• Potential foraging and breeding habitat exists within the study site and a main road separates surrounding habitat.</li> <li>• Extensive bandicoot trapping has taken place within the study area and this species has not been detected on site.</li> </ul>
<b>Conclusion</b>	Although the proposed action is likely to have an adverse effect on the life cycle of the species such that a viable local population is placed at risk of extinction, there is no evidence that a local population exists on site.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	Not applicable
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</b> <b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(d) in relation to the habitat of a threatened species, population or ecological community:</b> <b>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The majority of foraging, nesting and breeding habitat within the study site will be removed as a result of the project.</li> <li>• The action proposed will effect continuity of habitat and wildlife corridors in the area</li> </ul>
<b>Conclusion</b>	Proposed activity may affect habitat of the southern brown bandicoot, however despite

	intensive survey the species has not been detected on site.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>No individuals were identified on site and Southern brown bandicoots have a relatively limited home range (0.5-9 ha), limiting mobility of this species</li> </ul>
<b>Conclusion</b>	The potential habitat of this threatened species may become fragmented or isolated from other areas of habitat as a result of the proposed action.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>Existing presence of vegetation suitable to support foraging, breeding and shelter</li> <li>Habitat removal is permanent</li> <li>Other potential habitat exists for this species to move into however there are road and residential development barriers.</li> <li>Existing habitat is highly fragmented and risk of car or predator induced mortality when exposed/disturbed</li> </ul>
<b>Conclusion</b>	The importance of the habitat to be removed, modified, fragmented or isolated on the long-term survival of this species is low and there is no evidence that the Southern Brown Bandicoot is present within the study area.
<b>Criterion</b>	<b>(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>To date, no critical habitat has been declared for this species.</li> </ul>
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>A Southern brown bandicoot recovery plan was developed by NSW Department of Environment and Conservation in 2006.</li> <li>The recovery plan recommends management (retention and restoration) of habitat and better understand the distribution and abundance.</li> </ul>
<b>Conclusion</b>	The action proposed is consistent with the objectives/actions of the Southern Brown Bandicoot recovery plan.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>Native species constitute more 70% of vegetation cover within the study area.</li> </ul>
<b>Conclusion</b>	The proposed action constitutes the key threatening process 'Clearing of native vegetation'.



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**Overall Conclusion**

The proposed activity will permanently modify approximately 4.5 ha of remnant vegetation that is considered possible habitat for the Southern Brown Bandicoot. Due to the lack of habitat connectivity and the proximity to main roads, as well as the restricted mobility of this species and the extent of vegetation removal and clearing on the study site, if this species is present on site it will be significantly impacted by the proposed activity. However extensive trapping and other survey techniques have failed to find any evidence of this species existing within the study area. Therefore it is considered unlikely that the proposed action will have an impact on the Southern Brown Bandicoot.

A Species Impact Statement is not required.

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**Mitigation Measures**

Not applicable

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**Species: *Ninox strenua* (Powerful Owl)**

<b>Criterion</b>	<b>(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>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Potential foraging habitat within woodland vegetation of study site</li> <li>• Habitat supports prey availability of arboreal mammals</li> <li>• Potential roosting habitat within woodland vegetation of study site</li> <li>• Potential hollows suitable for nesting within study site</li> <li>• Require structurally heterogeneous habitat to provide suitable roosting sites</li> <li>• The proposed action will remove foraging and roosting habitat</li> <li>• This species is highly mobile with a large home range</li> </ul>
<b>Conclusion</b>	Although the proposed actions are likely to have an impact on the suitable habitat for this species, they are unlikely to have an adverse effect on the life cycle of the species such that a viable local population is placed at risk of extinction.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</b> <b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(d) in relation to the habitat of a threatened species, population or ecological community:</b> <b>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Existing presence of vegetation suitable to support foraging, breeding and shelter. Removal of hollow bearing trees that support arboreal prey.</li> <li>• The home range of an individual is between 400-1450 ha.</li> </ul>

<b>Conclusion</b>	The amount of habitat to be removed is a tiny portion of one individual's potential home range.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>Existing wildlife corridors are located nearby and this species is highly mobile.</li> </ul>
<b>Conclusion</b>	Habitat is highly unlikely to become fragmented and isolated from other areas of habitat as a result of the proposed action.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>Species is highly mobile and can survive in fragmented landscape</li> <li>As a top order predators this species is sensitive to habitat fragmentation</li> <li>Habitat to be removed is in an already fragmented, urbanized area</li> </ul>
<b>Conclusion</b>	The habitat to be removed is unlikely to be important to the long-term survival of the Powerful Owl.
<b>Criterion</b>	<b>(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>Not currently eligible for declaration of Critical Habitat as they are not listed as Endangered under Schedule 1 of the TSC Act.</li> </ul>
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.</b>
<b>Response</b>	<p>Recovery Plan for Large Forest Owls which includes the Powerful Owl recommends;</p> <ul style="list-style-type: none"> <li>the minimization of vegetation removal to protect potential foraging habitat for this species (including ground, understorey, logs and trees)</li> <li>retention of habitat (hollow bearing) trees</li> <li>protection of wildlife corridors and forest at landscape level</li> <li>exclusion zone around known nest and roost sites</li> </ul>
<b>Conclusion</b>	The proposed activity is consistent with this recovery plan if mitigation strategies are adopted.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>Native species constitute more 70% of vegetation cover within the study area</li> <li>Key threatening processes highlighted as having a negative effect on this species</li> </ul>
<b>Conclusion</b>	The proposed action constitutes the key threatening process 'Clearing of native vegetation'.

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**Overall Conclusion**

The proposed activity will permanently modify approximately 6 ha of remnant vegetation that is considered foraging, roosting and nesting habitat of the powerful owl. In addition to habitat loss there will be an associated impact on arboreal marsupial with reduced survival on potential prey species. However due to the mobility and large foraging and home range of this species, it is highly unlikely that the powerful owl will be significantly impacted by the proposed activity.

Preparation of a Species Impact Statement is not required.

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**Mitigation Measures**

Retention of mature and hollow bearing trees where possible and protection of wildlife corridor.

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**Species: *Pteropus poliocephalus* (Grey-headed Flying-fox)**

<b>Criterion</b>	<b>(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>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Grey-headed Flying-fox listed as Vulnerable under the TSC Act.</li> <li>• Roosting sites are located in the branches of large trees in rainforest patches, <i>Melaleuca</i> stands, mangroves, riparian woodland or modified vegetation in urban areas.</li> <li>• No camps are present on site or in the immediate surrounds.</li> </ul>
<b>Conclusion</b>	The proposed actions are unlikely to have an adverse affect on the life cycle of the species such that any potential viable population will be placed at risk of extinction.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</b> <b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(d) in relation to the habitat of a threatened species, population or ecological community:</b> <b>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• A small amount (less than 6 hectares) of potential foraging habitat is likely to be removed as a result of the proposed action.</li> </ul>
<b>Conclusion</b>	As there are no roosts within the study area and only minimal impacts on foraging habitat, the proposed activity is likely to have a negligible impact on the species habitat.

<b>Criterion</b>	<b>(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</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>Flying foxes are highly mobile, capable of foraging movements of up to 70 km from permanent camps</li> </ul>
<b>Conclusion</b>	It is highly unlikely any potential flying fox habitat will become fragmented or isolated as a result of the proposed actions.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>The study area does not support a permanent Grey-headed Flying-fox population</li> <li>No roosts located within the study area.</li> </ul>
<b>Conclusion</b>	The habitat to be removed/modified as a result of the proposed actions is likely to have little importance to the long-term survival of this species.
<b>Criterion</b>	<b>(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>To date, no critical habitat has been declared under the TSC Act for this species</li> </ul>
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>To date no recovery plan has been developed for this species.</li> <li>Threat abatement plans have prioritized protecting foraging and roosting habitat critical to the survival of the Grey-headed Flying-fox.</li> </ul>
<b>Conclusion</b>	Given the study area does not constitute key foraging or roosting habitat, the proposed actions are unlikely to impact on these threat abatement plans.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>Native species constitute more 70% of vegetation cover within the study area.</li> <li>Key threatening processes highlighted as having a negative effect on this species through the loss of foraging sites and potential roosting habitat.</li> </ul>
<b>Conclusion</b>	The proposed action constitutes the key threatening process 'Clearing of native vegetation'.

#### **Overall Conclusion**

It is unlikely the proposed actions will have any negative impact on any local population of the Grey-headed Flying-fox.

Species Impact Statement not required.

#### **Mitigation Measures**

Not applicable.

**Species: *Callocephalon fimbriatum* (Gang-gang Cockatoo) and *Calyptorhynchus lathami* (Glossy Black-cockatoo)**

**Reason for grouping: Cockatoo species with similar habitat requirements**

<b>Criterion</b>	(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>Response</b>	<ul style="list-style-type: none"> <li>• The Gang-gang Cockatoo and the Glossy Black-cockatoo are listed as 'Vulnerable' under the TSC Act.</li> <li>• These cockatoos are dependent on tree hollows for nesting and incubation of eggs (29 days).</li> <li>• These species feed almost exclusively on <i>Allocasurina</i> and <i>Casuarina</i> species.</li> <li>• This species is locally nomadic, moving to suitable nesting and feeding areas and gregarious groups of 10 or more individuals.</li> </ul>
<b>Conclusion</b>	Despite extensive bird surveys, these species have not been detected within the study area. Due to habitat requirements of tall, mature hollow bearing trees, it is unlikely that there is a local viable population on site. Therefore it is unlikely the actions proposed will place a local population at risk of extinction.
<b>Criterion</b>	(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
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<p>(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</p> <p>(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</p>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	(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.
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<p>(d) in relation to the habitat of a threatened species, population or ecological community:</p> <p>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed</p>

<b>Response</b>	<ul style="list-style-type: none"> <li>The preferred feed tree of both species, <i>Allocasuarina littoralis</i> (Black She-oak) is present on site.</li> <li>Approximately less than 4 ha of the area inhabited by <i>Allocasuarina</i> sp. will be removed by the proposed actions.</li> </ul>
<b>Conclusion</b>	A small portion of cockatoo feeding habitat will be removed by the proposed actions.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>The area is connected to a wildlife corridor with potential habitat for these cockatoo species.</li> <li>These species are highly mobile and nomadic, and capable of moving across the study area in search of suitable feeding/nesting habitat.</li> </ul>
<b>Conclusion</b>	Glossy Black-cockatoo and Gang-gang Cockatoo habitat is unlikely to become fragmented or isolated as a result of the proposed actions.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>The study area does not contain suitable nesting habitat, with mature hollow bearing trees being a limited resource on site.</li> </ul>
<b>Conclusion</b>	The habitat to be removed is unlikely to be important to the long-term survival of a local population of either of these cockatoo species.
<b>Criterion</b>	<b>(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>To date, no critical habitat has been declared for either of these species.</li> </ul>
<b>Conclusion</b>	Not applicable.
<b>Criterion</b>	<b>(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>A recovery plan has not been prepared for either the Gang-gang Cockatoo or Glossy Black-cockatoo.</li> <li>However priority actions have been developed to abate threats, including: increase public awareness and further research into these species.</li> </ul>
<b>Conclusion</b>	The actions will not negatively impact these threat abatement strategies.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>Native species constitute more 70% of vegetation cover within the study area</li> <li>Key threatening processes highlighted as having a negative effect on this species</li> </ul>
<b>Conclusion</b>	The proposed action constitutes the key threatening process 'Clearing of native vegetation'.

### Overall Conclusion

Given the study area contains sub-optimal nesting habitat, only a small amount of suitable feeding habitat and these species have not been detected on site, it is unlikely that that the area is important habitat for



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either the Gang-gang Cockatoo or the Glossy Black-cockatoo. However, mitigation strategies will ensure any potential impact will be reduced.

A Species Impact Statement is not required.

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#### **Mitigation Measures**

Replanting areas with casuarinas trees and promotion of their growth/development in areas from which they have been removed. Landscaping of the site should include the restoration of Casuarina/Allocasuarina trees. Retention of hollow bearing trees where possible.

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**Species: *Burhinus grallarius* (Bush Stone-curlew)**

<b>Criterion</b>	<b>(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>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The Bush Stone-curlew is listed as 'Endangered' under the TSC Act.</li> <li>• This species inhabits open forest or woodland habitat and nests on the ground in short grass, under trees.</li> <li>• Breeding occurs in spring, with eggs incubated for a 25 day period.</li> <li>• The Bush Stone-curlew is nocturnal, highly territorial and re-uses breeding sites.</li> </ul>
<b>Conclusion</b>	The removal of vegetation by the proposed actions will potentially have an adverse effect on the Bush Stone-curlew lifecycle due to removal of foraging and nesting habitat. However the species has not been encountered on site in either call-playback or visual bird surveys. Therefore it is unlikely that a viable local population is present on site.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</b> <b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(d) in relation to the habitat of a threatened species, population or ecological community:</b> <b>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The site contains less than 2 hectares of suitable habitat for the Bush-stone Curlew.</li> </ul>
<b>Conclusion</b>	There is a minor amount of Bush Stone-curlew habitat to be removed by the proposed actions.

<b>Criterion</b>	<b>(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</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Bush Stone-curlew habitat in this highly modified urban habitat is already fragmented by several major roads and houses surrounding the site and adjacent remnant vegetation.</li> <li>• However the site is approximately 6 ha and the home range of this species is 24-64 ha.</li> </ul>
<b>Conclusion</b>	The proposed action is unlikely to result in further fragmentation or isolation given the home range and territoriality of the species.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The majority of the study area is modified with weed infestation and a dense understorey.</li> <li>• The Bush Stone-curlew requires more open woodland with a sparse grassy ground layer and fallen timber.</li> </ul>
<b>Conclusion</b>	The habitat within the study area is not optimal for either nesting or foraging and any habitat to be removed or modified is unlikely to be of importance to the survival of a local population of Bush Stone-curlew.
<b>Criterion</b>	<b>(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• To date, no critical habitat has been declared for the Bush Stone-curlew.</li> </ul>
<b>Conclusion</b>	Not applicable.
<b>Criterion</b>	<b>(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• A recovery plan was developed by the Department of Environment and Conservation, NSW (DEC) in 2006.</li> <li>• Actions proposed in the plan include; the management of Bush Stone-curlew habitat (predator control, retention of fallen timber and ground/shrub cover), community awareness and ecological research.</li> </ul>
<b>Conclusion</b>	The actions proposed are unlikely to impact on these recovery objectives.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Native species constitute more 70% of vegetation cover within the study area</li> <li>• Key threatening processes highlighted as having a negative effect on this species</li> </ul>
<b>Conclusion</b>	The proposed action constitutes the key threatening process 'Clearing of native vegetation'.

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**Overall Conclusion**

The Bush Stone-curlew was not detected in the study area during seasonal diurnal and nocturnal surveys. The site is also dominated by dense understorey vegetation unsuitable for this species. Therefore it is unlikely that the proposed actions will negatively impact on any potential population in the area.

A Species Impact Statement is not required.

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**Mitigation Measures**

Not applicable.

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**Species: *Daphoenositta chrysoptera* (Varied Sittella), *Glossopsitta pusilla* (Little Lorikeet), *Petroica boodang* (Scarlet Robin), *Stagonopleura guttata* (Diamond Firetail), *Lathamus discolor* (Swift Parrot)**

**Grouping: Woodland birds**

<b>Criterion</b>	<b>(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>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Varied Sittella, Little Lorikeet, Scarlet Robin and Diamond Firetail are listed as 'Vulnerable' under the TSC Act.</li> <li>• Swift parrot is listed as 'Endangered' under the TSC Act.</li> <li>• Little Lorikeet require large hollow-bearing trees for nesting</li> <li>• Varied Sittella construct nests in tall living trees</li> <li>• Scarlet Robin constructs nests on tall dead trees and require abundant coarse woody debris.</li> <li>• The Swift Parrot breeds in Tasmania and migrates to the mainland in autumn.</li> </ul>
<b>Conclusion</b>	The habitat requirements necessary for these species are not abundant on the study site, with limited hollow bearing trees and very few mature trees. Therefore it is unlikely that the actions proposed will have an adverse affect on any species such that any potential viable local population would be placed at risk of extinction.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</b> <b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable

<b>Criterion</b>	<b>(d) in relation to the habitat of a threatened species, population or ecological community:</b>
	<b>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>The 6 ha site provides very limited foraging, roosting and nesting opportunities for these woodland bird species.</li> </ul>
<b>Conclusion</b>	The extent of woodland bird habitat to be removed by the proposed actions will be minor.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>The site is bordered by bushland reserve and remnant vegetation.</li> <li>Some of these species are nomadic and all are capable of moving between vegetation patches.</li> </ul>
<b>Conclusion</b>	It is unlikely that the proposed actions will result in the fragmentation or isolation of woodland bird habitat.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>The site provides limited foraging, roosting and nesting habitat.</li> <li>Highly disturbed and weed infested site</li> </ul>
<b>Conclusion</b>	The habitat to be removed is unlikely to be important to the long term survival of these five woodland bird species
<b>Criterion</b>	<b>(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>To date, no critical habitat has been declared for these woodland bird species.</li> </ul>
<b>Conclusion</b>	Not applicable.
<b>Criterion</b>	<b>(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>No recovery plan has been developed for the Varied Sittella, Little Lorikeet, Scarlet Robin or Diamond Firetail.</li> <li>Priority actions have been identified for the Diamond Firetail surrounding monitoring, research and community awareness.</li> <li>A national recovery plan has been developed for the Swift Parrot (Birds Australia, 2011).</li> <li>The management and protection of Swift Parrot habitat at a landscape level and population monitoring are key objectives of this recovery plan.</li> </ul>
<b>Conclusion</b>	The actions proposed are unlikely to impact on the recovery and threat abatement plans highlighted for the Swift Parrot and Diamond Firetail.

<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Native species constitute more 70% of vegetation cover within the study area.</li> <li>• Key threatening processes highlighted as having a negative effect on this species.</li> </ul>
<b>Conclusion</b>	The proposed action constitutes the key threatening process 'Clearing of native vegetation'.

#### **Overall Conclusion**

Due to the limited availability of habitat requirements necessary for these species, their absences during seasonal surveys and mobile nature of these woodland birds, it is unlikely that the proposed actions will negatively impact any of the five species to the extent they will be placed at risk of localised extinction.

No Species Impact Statements are required.

#### **Mitigation Measures**

Not applicable.

**Species: *Hieraaetus morphnoides* (Little Eagle), *Ninox connivens* (Barking Owl), *Tyto novaehollandiae* (Masked Owl), *Tyto tenebricosa* (Sooty Owl)**

**Grouping: Forest owls and birds of prey**

<b>Criterion</b>	<b>(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>
<b>Response</b>	<ul style="list-style-type: none"> <li>• All four species are listed as 'Vulnerable' under the TSC Act.</li> <li>• The Little Eagle, Barking Owl and Masked Owl all roost in tall, mature tree canopies.</li> <li>• The Sooty Owl utilises large hollows for both roosting and breeding, while Barking and Masked Owls utilize hollows for breeding as well.</li> </ul>
<b>Conclusion</b>	Large, mature trees and hollow-bearing trees are extremely limited resources within the study area. It is unlikely that the site would be able to sustain viable local populations of any of these species.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</b> <b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(d) in relation to the habitat of a threatened species, population or ecological community:</b> <b>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The study area is 6 ha and suitable roosting breeding habitat is located in a small portion of the site.</li> <li>• The study area contains populations of common ringtail possums, black rat and other small-medium mammals that may be suitable foraging resources.</li> </ul>



<b>Conclusion</b>	Forest owl and birds of prey habitat to be removed is minor.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>The habitat to be removed is surrounded by remnant vegetation of varied quality.</li> <li>These species are highly mobile, with home ranges ranging between 2000-6000 ha (Barking Owl), 500-1000 ha (Masked Owl) and 400-3000 ha (Sooty Owl).</li> </ul>
<b>Conclusion</b>	Given the mobility of these species, their large home ranges and the unsuitability of the study site for roosting and breeding, it is highly unlikely that the proposed actions will result in the fragmentation or isolation of owl/eagle habitat.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>Very few trees within the study site have hollows and all are limited in size.</li> </ul>
<b>Conclusion</b>	The habitat to be removed is unlikely to be important to the long term survival of these four species.
<b>Criterion</b>	<b>(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>To date, no critical habitat has been declared for any of these species.</li> </ul>
<b>Conclusion</b>	Not applicable.
<b>Criterion</b>	<b>(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>No recovery plan has been developed for the Little Eagle and Barking Owl.</li> <li>A Recovery Plan for Large Forest Owls was developed by DEC (2006) and includes the Masked Owl and Sooty Owl.</li> <li>It recommends; the minimization of vegetation removal to protect potential foraging habitat for this species (including ground, understorey, logs and trees), retention of habitat (hollow bearing) trees, protection of wildlife corridors and forest at landscape level, exclusion zone around known nest and roost sites.</li> </ul>
<b>Conclusion</b>	Given that these species have not been detected in both diurnal or nocturnal surveys and the unsuitable habitat on site, it is unlikely that the action proposed will impact on these recovery actions.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>Native species constitute more 70% of vegetation cover within the study area.</li> <li>Key threatening processes highlighted as having a negative effect on this species.</li> </ul>
<b>Conclusion</b>	The proposed action constitutes the key threatening process 'Clearing of native vegetation'.

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**Overall Conclusion**

Given that these species have not been detected in either diurnal or nocturnal surveys, the unsuitable habitat on site and large home ranges of these four species it is unlikely that the action proposed will negatively impact on the Little Eagle, Barking Owl, Masked Owl and Sooty Owl.

A Species Impact Statement is not required.

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**Mitigation Measures**

Not applicable.

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**Species: *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat), *Mormopterus norfolkensis* (Eastern Freetail-bat), *Myotis macropus* (Southern Myotis), *Saccolaimus flaviventris* (Yellow-bellied Sheath-tail-bat), *Scoteanax rueppellii* (Greater Broad-nosed Bat)**

**Grouping: Microbats**

<b>Criterion</b>	<b>(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>
<b>Response</b>	<ul style="list-style-type: none"> <li>• These five microbat species are listed as 'Vulnerable' under the TSC Act.</li> <li>• No roosting structures or maternity caves have been identified on site and it is highly unlikely that breeding is occurring within the study area.</li> </ul>
<b>Conclusion</b>	The proposed actions are unlikely to have an adverse effect on the life cycle of these species such that a viable local population is placed at risk of extinction.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</b>  <b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(d) in relation to the habitat of a threatened species, population or ecological community:</b>  <b>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• There will be some loss of potential foraging habitat for these bat species but the site is not considered to provide significant foraging habitat and it is unlikely they will be utilizing this area for roosting given the lack of roosting sites and caves on site.</li> </ul>

<b>Conclusion</b>	The actions proposed will result in a limited amount of microbat habitat to be removed.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• These species are highly mobile, with the Eastern Bentwing-bat capable of dispersing within a 300 km range of maternity caves.</li> <li>• The Yellow-bellied Sheath-tail-bat potentially migrates seasonally.</li> <li>• The area of habitat to be removed is approximately 6 ha in size.</li> </ul>
<b>Conclusion</b>	It is highly unlikely the microbat habitat will become fragmented or isolated as a result of the proposed actions.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• These species require suitable roosting, breeding and foraging habitat.</li> </ul>
<b>Conclusion</b>	Given the habitat on site is not adequate to sustain populations of these microbat species it is unlikely the habitat to be modified or removed is important to the long-term survival of any of these bat species.
<b>Criterion</b>	<b>(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• To date, no critical habitat has been declared for any of the five microbat species.</li> </ul>
<b>Conclusion</b>	Not applicable.
<b>Criterion</b>	<b>(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• To date, no recovery plan has been developed for any of these five microbat species.</li> </ul>
<b>Conclusion</b>	Not applicable.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Native species constitute more 70% of vegetation cover within the study area.</li> <li>• Key threatening processes highlighted as having a negative effect on this species.</li> </ul>
<b>Conclusion</b>	The proposed action constitutes the key threatening process 'Clearing of native vegetation'.

#### Overall Conclusion

There is very little suitable foraging or roosting habitat available for the five threatened micro bat species within the study area. While the proposed works may impact on some potential foraging habitat, the small area of disturbance and the wildlife corridor located nearby will ensure there is unlikely to be a significant impact on these species.

A Species Impact Statement is not required.

#### Mitigation Measures

Not applicable.

**Species: *Heleioporus australiacus* (Giant Burrowing Frog) and *Pseudophryne australis* (Red-crowned Toadlet)**

**Grouping: Frogs**

<b>Criterion</b>	<b>(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>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The Giant Burrowing Frog and Red-crowned Toadlet are both listed as 'Vulnerable' under the TSC Act.</li> <li>• Non-breeding habitat for the Giant Burrowing Frog is located below the soil surface or leaf litter, particularly along sandstone ridge tops.</li> <li>• Breeding habitat can consist of soaks or pools, seepage lines and small pools of collected water.</li> <li>• The Red-crowned Toadlet have a preference for steep escarpments and outcroppings, under bush-rock or logs.</li> <li>• Both species have a restricted home range.</li> </ul>
<b>Conclusion</b>	It is unlikely that the viable local populations of either of these species exist within the study area, with no sandstone ridges, rock outcroppings or escarpments located on the site. Therefore the proposed actions are unlikely to have an adverse effect on the lifecycle of either the Giant Burrowing Frog or the Red-crowned Toadlet.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</b> <b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(d) in relation to the habitat of a threatened species, population or ecological community:</b>

<b>Response</b>	<b>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed</b>
	<ul style="list-style-type: none"> <li>The habitat preferences of these species require sandstone ridgetops and steep escarpments in addition to open woodland.</li> <li>The study area does not contain any ridges, escarpments or bush rock.</li> </ul>
<b>Conclusion</b>	The amount of Giant Burrowing Frog and Red-crowned Toadlet habitat to be removed by the proposed actions will be minor.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>Red-crowned Toadlet and Giant Burrowing Frog habitat is highly fragmented in this urban landscape.</li> </ul>
<b>Conclusion</b>	Given the high level of fragmentation and the minor amount of frog habitat to be removed, it is unlikely the proposed actions will greatly increase the fragmentation or isolation of this habitat.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>Neither of these species has been detected within the study area, and potential frog habitat to be removed is minor.</li> </ul>
<b>Conclusion</b>	The habitat to be removed by the proposed action is unlikely to be important to the long-term survival of either the Red-crowned Toadlet or the Giant Burrowing Frog in this locality.
<b>Criterion</b>	<b>(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>To date, no critical habitat has been declared for these two species.</li> </ul>
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>A recovery plan has not been developed for either of these species.</li> <li>20 priority actions have been identified for the Giant Burrowing Frog and 14 priority actions have been identified for the Red-crowned Toadlet surrounding the development of monitoring and research goals.</li> </ul>
<b>Conclusion</b>	The actions proposed are unlikely to negatively impact on these priority actions.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>Native species constitute more 70% of vegetation cover within the study area.</li> <li>Key threatening processes highlighted as having a negative effect on this species.</li> </ul>
<b>Conclusion</b>	The proposed action constitutes the key threatening process 'Clearing of native vegetation'.

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**Overall Conclusion**

Only a small amount of suitable habitat for these species is located within the study area. Neither the Red-crowned Toadlet nor the Giant Burrowing Frog was detected in either diurnal or nocturnal surveys (including call play back, pitfall trapping and active searches). Therefore, it is unlikely that the proposed actions would negatively impact on any local population of either of these two species.

A Species Impact Statement is not required.

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**Mitigation Measures**

Not applicable.

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**Species: *Cercartetus nanus* (Eastern Pygmy-possum)**

<b>Criterion</b>	<b>(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>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The Eastern Pygmy-possum is listed as 'Vulnerable' under the TSC Act.</li> <li>• This species can nest in a variety of structures, including; tree hollows, stumps, ground holes, vegetation thicket, Common Ringtail possum dreys and abandoned bird nests.</li> <li>• Breeding normally occurs between spring and autumn but can be dependent on food availability, including nectar and pollen from flowering banksias, eucalyptus and bottlebrush.</li> </ul>
<b>Conclusion</b>	Nesting sites are readily available for the Eastern Pygmy-possum throughout the study area, although nutritional resources are likely to be limited. Although this species has potential to occur, it is unlikely that the site holds a viable local population.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</b> <b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(d) in relation to the habitat of a threatened species, population or ecological community:</b> <b>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Approximately 6 hectares of vegetation is to be removed as a result of the proposed action.</li> <li>• The majority of this vegetation is suitable Eastern Pygmy-possum habitat.</li> </ul>



<b>Conclusion</b>	Six hectares of potential Eastern Pygmy-possum habitat is likely to be removed as part of the proposed action.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The Eastern Pygmy-possum is small (15-43 grams) with a home range of approximately 0.68 ha for males and 0.35 ha for females.</li> <li>• Habitat is already fragmented due to several main roads surrounding the study area.</li> </ul>
<b>Conclusion</b>	Eastern Pygmy-possum habitat is likely to become more isolated from other areas of habitat as a result of the proposed action.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The habitat to be removed contains suitable nesting resources but limited feeding resources.</li> <li>• Better quality habitat is located nearby in the adjacent wildlife corridor, but separated from the study area by a main road that is potentially a barrier to dispersal.</li> </ul>
<b>Conclusion</b>	The habitat to be removed is moderately important to any potential Eastern Pygmy-possums on site, but is unlikely to be important to the long-term survival of the species.
<b>Criterion</b>	<b>(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• To date, no critical habitat has been declared for the Eastern Pygmy-possum.</li> </ul>
<b>Conclusion</b>	Not applicable.
<b>Criterion</b>	<b>(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• To date, no recovery plan has been developed for the Eastern Pygmy Possum.</li> <li>• Seven priority actions have been identified to aid the recovery of the species and include field surveys, feral predator control and an increase in ecological research into the species.</li> </ul>
<b>Conclusion</b>	The actions proposed are unlikely to negatively impact on any of these recovery actions.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Native species constitute more 70% of vegetation cover within the study area.</li> <li>• Key threatening processes highlighted as having a negative effect on this species.</li> </ul>
<b>Conclusion</b>	The proposed action constitutes the key threatening process 'Clearing of native vegetation'.

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### **Overall Conclusion**

Field surveys of the study area failed to detect this species through Elliot and pitfall traps. However intensive trapping programs previously undertaken in New South Wales have produced low rates of detection. This suggests the species may still be present within the study area despite not being detected during trapping surveys. The 6 ha of vegetation to be cleared by the proposed works contain potential Eastern Pygmy-possum habitat. If the Eastern Pygmy-possum is located within the study area, the proposed works will impact on individuals. It is unlikely that the proposed works will place the local population at risk of extinction, with individuals potentially existing within the remnant bushland and wildlife corridor located nearby. However, to offset any potential impacts, mitigation measures have been proposed to enhance the surrounding habitat to provide suitable Eastern Pygmy-possum habitat nearby.

A Species Impact Statement is not required.

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### **Mitigation Measures**

Offset strategies should include providing nest boxes throughout 6 hectares of suitable habitat located nearby to meet nesting requirements for the Eastern Pygmy-possum.

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**Species: *Dasyurus maculatus* (Spotted-tailed Quoll)**

<b>Criterion</b>	<b>(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>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The Spotted-tailed Quoll is listed as 'Vulnerable' under the TSC Act.</li> <li>• This species has a preference for hollow-bearing trees, logs, caves and rocks as den sites.</li> <li>• Breeding occurs between April and July, with juveniles becoming independent around 18 weeks.</li> <li>• The study area has limited den sites availability and no evidence of the presence of Spotted-tailed Quoll (ie. latrine sites, captures, sightings).</li> </ul>
<b>Conclusion</b>	It is highly unlikely that the proposed actions will have an adverse effect on the life cycle of this species such that a local population would be places at risk of extinction.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</b> <b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(d) in relation to the habitat of a threatened species, population or ecological community:</b> <b>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Spotted-tailed Quoll inhabit a range of different vegetation and landscape types, with a preference for sclerophyll forests, woodland, coastal heathland, rainforest, rocky cliffs and boulder fields.</li> </ul>
<b>Conclusion</b>	Six hectares of potential habitat will be removed by the proposed actions.

<b>Criterion</b>	<b>(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</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The home range of this species is estimated between 800 ha and 20 km<sup>2</sup>.</li> <li>• The Spotted-tailed Quoll is highly mobile and can move several kilometers throughout the night.</li> </ul>
<b>Conclusion</b>	Spotted-tailed Quoll habitat is highly unlikely to become fragmented or isolated as a result of the proposed action.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The study area has limited den sites.</li> <li>• The area comprises a small fragment of a quolls home range.</li> </ul>
<b>Conclusion</b>	The habitat to be removed is highly unlikely to be important to the long-term survival of this species.
<b>Criterion</b>	<b>(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• To date, no critical habitat has been declared for this species.</li> </ul>
<b>Conclusion</b>	Not applicable.
<b>Criterion</b>	<b>(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• To date, a recovery plan has not been developed for the Spotted-tailed Quoll.</li> <li>• 35 priority actions have been identified to aid in the recovery of this species and include monitoring, ecological and genetic research and community consultation.</li> </ul>
<b>Conclusion</b>	The proposed actions will not impact on these threat abatement plans.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Native species constitute more 70% of vegetation cover within the study area.</li> <li>• Key threatening processes highlighted as having a negative effect on this species.</li> </ul>
<b>Conclusion</b>	The proposed action constitutes the key threatening process 'Clearing of native vegetation'.
<b>Overall Conclusion</b>	
It is highly unlikely that the proposed actions will negatively impact on the Spotted-tailed Quoll. A Species Impact Statement is not required.	
<b>Mitigation Measures</b>	
Not applicable.	

**Species: *Petaurus australis* (Yellow-bellied Glider)**

<b>Criterion</b>	<b>(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>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The Yellow-bellied Glider is listed as 'Vulnerable' under the TSC Act.</li> <li>• This species inhabit hollow-bearing trees as den sites and live in a small family unit.</li> <li>• They require sap produce trees, winter flowering eucalypts and mature den trees.</li> <li>• Breeding occurs between May and September, with young remaining in the pouch for 100 days and the nest for an additional 60 days.</li> <li>• The study area has only limited resources to support a population or family unit of Yellow-bellied Gliders.</li> <li>• Trapping and spotlighting surveys did not detect this species within the study area.</li> </ul>
<b>Conclusion</b>	The actions proposed are unlikely to have an adverse effect on the life-cycle of the species such that a viable local population is placed at risk of extinction.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</b> <b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(d) in relation to the habitat of a threatened species, population or ecological community:</b> <b>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Less than 6 ha of potential Yellow-bellied Glider habitat is likely to be removed as a result of the proposed actions.</li> <li>• Only a small amount of mature eucalyptus trees are present within the study area.</li> </ul>

<b>Conclusion</b>	Potential Yellow-bellied Glider habitat to be removed by the proposed actions is minor.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>This species is very mobile and has a home range between 20-85 hectares. They are capable of dispersing in search of nutritional resources.</li> </ul>
<b>Conclusion</b>	It is unlikely that the proposed action will result in an increase in the fragmentation or isolation of Yellow-bellied Glider habitat.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>The nesting and nutritional resources available within the study area is limited for this species.</li> </ul>
<b>Conclusion</b>	The habitat to be removed is unlikely to hold much importance for the long-term survival of this species.
<b>Criterion</b>	<b>(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>To date, no critical habitat has been declared for this species.</li> </ul>
<b>Conclusion</b>	Not applicable.
<b>Criterion</b>	<b>(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>NSW Parks and Wildlife Service developed a New South Wales recovery plan in 2006. Recovery objectives include the conservation of Yellow-bellied Glider habitat, monitor populations, conduct ecological research and raise community awareness.</li> </ul>
<b>Conclusion</b>	The proposed actions are unlikely to interfere with any of these recovery plan objectives.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>Native species constitute more 70% of vegetation cover within the study area</li> <li>Key threatening processes highlighted as having a negative effect on this species</li> </ul>
<b>Conclusion</b>	The proposed action constitutes the key threatening process 'Clearing of native vegetation'.

#### Overall Conclusion

This species has not been detected within the study area throughout trapping and spotlight surveys. There is only limited resources available to this species. Therefore it is unlikely that the proposed actions will negatively impact on the Yellow-bellied Glider.

A Species Impact Statement is not required.

#### Mitigation Measures

Retention of hollow bearing trees where possible.

**Species: *Phascolarctos cinereus* (Koala)**

<b>Criterion</b>	<b>(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>
<b>Response</b>	<ul style="list-style-type: none"> <li>• This species is listed as 'Vulnerable' under the TSC Act.</li> <li>• The study area contains a small amount of feed and shelter tree species.</li> <li>• It is highly unlikely that a local population exists on site.</li> </ul>
<b>Conclusion</b>	The mature trees that are to be impacted as part of the proposed works are not considered to provide foraging resources suitable to sustain a local Koala population. Therefore it is unlikely the proposed works will have an adverse effect on the life cycle of this species to the extent that any potential local population will be placed at risk of extinction.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</b> <b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(d) in relation to the habitat of a threatened species, population or ecological community:</b> <b>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Less of than 6 ha of vegetation to be cleared by the proposed actions.</li> <li>• Of these 6 hectares, a small portion holds suitable Koala habitat.</li> </ul>
<b>Conclusion</b>	A minor amount of Koala habitat is likely to be removed as a result of the proposed action.

<b>Criterion</b>	<b>(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</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• This species has the ability to modify their home range depending on the quality and amount of food available within an area, capable of occupying home ranges of several hundred hectares.</li> <li>• The koala can move over open ground in search of food trees.</li> </ul>
<b>Conclusion</b>	Given the mobility of the species and the restricted habitat available on site, it is unlikely the habitat will become isolated as a result of the proposed actions.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The Koala can feed from over 100 tree species. Feed and shelter trees on site are limited.</li> </ul>
<b>Conclusion</b>	The habitat to be removed/modified is highly unlikely to be important to the long-term survival of species.
<b>Criterion</b>	<b>(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• To date, no critical habitat has been declared for this species.</li> </ul>
<b>Conclusion</b>	Not applicable.
<b>Criterion</b>	<b>(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• A recovery plan has been developed for the Koala (DECC, 2008a) and includes an overall objectives to 'reverse the decline of the Koala in New South Wales, to ensure adequate protection, management and restoration of koala habitat, and to maintain healthy breeding populations of koalas throughout their current range'.</li> </ul>
<b>Conclusion</b>	As there is no breeding population of koalas, or adequate koala habitat, on site the actions proposed will not interfere with the objectives of the recovery plan.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Native species constitute more 70% of vegetation cover within the study area</li> <li>• Key threatening processes highlighted as having a negative effect on this species.</li> </ul>
<b>Conclusion</b>	The proposed action constitutes the key threatening process 'Clearing of native vegetation'.

#### **Overall Conclusion**

The proposed actions are unlikely to negatively impact on the Koala given the low value of potential habitat on site, adjacent wildlife corridor and mobility of the species.

A Species Impact Statement is not required.

#### **Mitigation Measures**

Retention of mature Eucalyptus trees on site where possible.



**Species: *Varanus rosenbergi* (Rosenberg's Goanna)**

<b>Criterion</b>	<b>(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>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Rosenberg's Goanna is listed as 'Vulnerable' under the TSC Act.</li> <li>• Its key habitat requirements are termite mounds for nesting and large expanses.</li> <li>• The study area does not contain any termite mounds.</li> </ul>
<b>Conclusion</b>	It is unlikely that the proposed actions will have an adverse effect on the life cycle of this species given the area does not meet its key nesting requirements.
<b>Criterion</b>	<b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</b>  <b>(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</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	
<b>Conclusion</b>	Not applicable
<b>Criterion</b>	<b>(d) in relation to the habitat of a threatened species, population or ecological community:</b>  <b>(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Rosenberg's Goanna shelter in hollow logs, burrows and under rock crevices, and requires termite mounds for nesting.</li> <li>• The site does contain nutritional resources, with this species feeding on carrion, reptiles and small mammals that are available with the study area.</li> </ul>
<b>Conclusion</b>	The study area contains sub-optimal habita for this species, therefore any Rosenberg's Goanna habitat to be removed as a result of the proposed actions will be minimal.

<b>Criterion</b>	<b>(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</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Individuals require large areas to move over and are highly mobile.</li> <li>• The study area is contained within 6 ha of sub-optimal habitat.</li> </ul>
<b>Conclusion</b>	Habitat is unlikely to become more fragmented or isolated as a result of the proposed actions.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Limited nesting and shelter resources available within the study area.</li> </ul>
<b>Conclusion</b>	The habitat to be removed is unlikely to impact on the long-term survival of this species.
<b>Criterion</b>	<b>(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• To date, no critical habitat has been declared for this species.</li> </ul>
<b>Conclusion</b>	Not applicable.
<b>Criterion</b>	<b>(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• To date, no recovery plans have been developed for Rosenberg's Goanna.</li> <li>• Nine priority actions have been identified, concerning increased knowledge of the ecology and habitat of this species and community engagement.</li> </ul>
<b>Conclusion</b>	The actions proposed are consistent with these recovery strategies.
<b>Criterion</b>	<b>(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.</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Native species constitute more 70% of vegetation cover within the study area</li> <li>• Key threatening processes highlighted as having a negative effect on this species</li> </ul>
<b>Conclusion</b>	The proposed action constitutes the key threatening process 'Clearing of native vegetation'.

#### **Overall Conclusion**

The proposed actions are unlikely to negatively impact Rosenberg's Goanna due to the sub-optimal habitat requirements available on site and the large home range size of this species.

A Species Impact Statement is not required.

#### **Mitigation Measures**

Not applicable.

# Appendix 6

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## EPBC Act assessments of significance



**NOTE:**

In assessing matters of National Environmental Significance (NES) associated with impact or potential impact on:

- Wetlands of international importance<sup>3</sup>
- Listed threatened species and communities<sup>4</sup>
- Listed migratory species<sup>5</sup>

These assessments may have been undertaken with prescribed designated mitigation measures that form part of the 'Action<sup>6</sup>'. The effect of which is that these mitigation measures become a mandatory obligation based on Consent Authority approval to proceed.

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<sup>3</sup> As detailed in Subdivision B, Division I, Part 3 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

<sup>4</sup> As detailed in Subdivision C, Division I, Part 3 of the EPBC Act

<sup>5</sup> As detailed in Subdivision D, Division I, Part 3 of the EPBC Act

<sup>6</sup> Action is as detailed in Section 523 of the EPBC Act

**Species Name: *Grevillea caleyi* (Caley's Grevillea) - E, *Microtis angusii* (Angus's Onion Orchid) - E, *Persoonia hirsuta* (Hairy Geebung) -E, *Prostanthera marifolia* (Seaforth Mintbush) - CE**

<b>Criterion</b>	<b>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:</b>
<b>Response</b>	<p><b>i. lead to a long-term decrease in the size of a population</b></p> <ul style="list-style-type: none"> <li>• These species are known to occur in Duffys Forest Ecological Community (DFEC) which occurs on the study area.</li> <li>• No critically endangered or endangered species were recorded in the study area following extensive targeted searches.</li> </ul>
<b>Conclusion</b>	It is unlikely that these species occur on site. Therefore the proposed action is not likely to have a significant impact on these species leading to a long-term decrease in the size of potentially occurring populations through loss of quality habitat.
<b>Criterion</b>	<b>ii. reduce the area of occupancy of the species</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• 4.25 ha of potential habitat for these species is proposed to be removed from the subject site.</li> <li>• These species will not be able to occupy the study area after the proposed activity.</li> </ul>
<b>Conclusion</b>	The proposed action is likely to reduce the area of occupancy of these species.
<b>Criterion</b>	<b>iii. fragment an existing population into two or more populations</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• No critically endangered or endangered species' populations were recorded on the study area following extensive targeted searches.</li> <li>• Apart from one record of Caley's Grevillea has been recorded 150 m north of the study area no other existing populations of critically endangered or endangered species occur in the vicinity of the site.</li> </ul>
<b>Conclusion</b>	The proposed activity is unlikely to fragment an existing population into two or more populations.
<b>Criterion</b>	<b>iv. adversely affect habitat critical to the survival of a species</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• No critical habitat has been declared for these species</li> </ul>
<b>Conclusion</b>	The proposed activity is unlikely to adversely affect habitat critical to the survival of these species.
<b>Criterion</b>	<b>v. disrupt the breeding cycle of a population</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• No critically endangered or endangered species' populations were recorded on the study area following extensive targeted searches.</li> </ul>
<b>Conclusion</b>	The proposed activity is unlikely to disrupt the breeding cycle of potentially occurring populations of these species.

<b>Criterion</b>	<b>vi. modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• 4.25 ha of moderate to good quality DFEC within study area will be destroyed</li> <li>• These species were not recorded on the site after extensive targeted searches.</li> <li>• These species are known to occur in Duffys Forest Ecological Community which occurs on the study area.</li> <li>• The action proposed will remove potential habitat for these species.</li> </ul>
<b>Conclusion</b>	The availability and quality of habitat will substantially decrease to the extent that these species are likely to decline.
<b>Criterion</b>	<b>vii. result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The Project has the potential to aid the spread of weeds due to the movement and/or introduction of soil, vehicles and equipment.</li> <li>• A Site Erosion and Sediment Control Plan or Soil Water Management Plan, in accordance with the Blue Book, is to be implemented for the Project.</li> </ul>
<b>Conclusion</b>	It is unlikely that the proposed action will result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.
<b>Criterion</b>	<b>viii. introduce disease that may cause the species to decline</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The study area is potentially infected with <i>Phytophthora cinnamomi</i>.</li> <li>• Caley's Grevillea, Hairy Geebung and Seaforth Mintbush are potentially susceptible to <i>Phytophthora</i> infection since they have been recorded in the vicinity of known <i>Phytophthora</i> infection.</li> <li>• Habitat disturbance may aid the spread of <i>Phytophthora</i>.</li> <li>• Controls on the movement of vehicles, and human traffic into Duffys Forest vegetation habitat.</li> <li>• Western Australian Conservation and Land Management guidelines for <i>Phytophthora cinnamomi</i> will be adopted to minimise infection in to other areas.</li> <li>• The proposed management controls for <i>Phytophthora</i> will reduce the risk of spread this pathogen.</li> </ul>
<b>Conclusion</b>	It is unlikely that the proposed action will introduce disease that may cause these species to decline.
<b>Criteria</b>	<b>ix. interfere with the recovery of the species</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The proposed activity will result in the removal of 4.25 ha of DFEC on the subject site.</li> <li>• Proposed habitat loss is not consistent with the recovery plan for these species.</li> </ul>
<b>Conclusion</b>	The proposed activity is unlikely to interfere with the recovery of these species.

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### **Overall Conclusion**

The proposed activity will permanently remove approximately 4.25 ha of remnant DFEC, which provides potential habitat for these species. However, despite targeted surveys, these species were not located within the study area. While it is unlikely these species are present, mitigation measures have been proposed to protect potential habitat and reduce threats. The proposed activity is unlikely to have a significant impact on these endangered and critically endangered species.

Referral to DSEWPaC is not required.

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### **Mitigation Measures**

- Retention of remnant of DFEC on former Blinking Light Reserve land to east of Bantry Bay Road.
  - Management of threats to retained remnant vegetation (weed invasion, Phytophthora infection, inappropriate fire regimes and public access to habitat).
  - Offsetting of DFEC.
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**Species: *Pimelea curvula* var. *curvula* - V, *Tetratheca glandulosa* (Glandular Pink-bell) - V**

<b>Criterion</b>	<b>An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:</b>
<b>Response</b>	<p><b>i. lead to a long-term decrease in the size of an important population of a species</b></p> <ul style="list-style-type: none"> <li>• <i>Pimelea curvula</i> var. <i>curvula</i> and Glandular Pink-bell occur within a 1 km of the study area, but none of these records are in the study area and no specimens were found after targeted surveys for these species on the study area.</li> <li>• No important populations of this species have been identified in relation to the study area.</li> </ul>
<b>Conclusion</b>	The project will not lead to a long-term decrease in the size of an important population of this species.
<b>Criterion</b>	<b>ii. reduce the area of occupancy of an important population</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• <i>Pimelea curvula</i> var. <i>curvula</i> and Glandular Pink-bell occur within a 1 km of the study area, but none of these records are in the study area and no specimens were found after targeted surveys for these species on the study area.</li> <li>• No important populations of this species have been identified in relation to the study area.</li> </ul>
<b>Conclusion</b>	The project will not reduce the extent of area of occupancy of an important population of this species.
<b>Criterion</b>	<b>iii. fragment an existing important population into two or more populations</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• <i>Pimelea curvula</i> var. <i>curvula</i> and Glandular Pink-bell have been recorded in bushland to the east of the study area, but none of these records are in the study area and no specimens were found after targeted surveys for these species on the study area</li> <li>• It is unlikely that these populations extend to other areas around the study area since these areas are in built up residential separated by major roads</li> </ul>
<b>Conclusion</b>	The project will not fragment an existing population into two or more populations.
<b>Criterion</b>	<b>iv. adversely affect habitat critical to the survival of a species</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• No critical habitat has been declared for these species.</li> </ul>
<b>Conclusion</b>	The project will not adversely affect habitat critical to the survival of this species.
<b>Criterion</b>	<b>v. disrupt the breeding cycle of an important populations</b>
<b>Response &amp; conclusion</b>	No important populations of this species have been identified in relation to the study area.

<b>Criterion</b>	<b>vi. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>The majority of potential habitat within study area (4.25 ha) will be destroyed</li> </ul>
<b>Conclusion</b>	The availability and quality of habitat will substantially decrease to the availability of potential quality habitat to the extent that these species are likely to decline.
<b>Criterion</b>	<b>vii. result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat</b>
<b>Response</b>	The project has the potential to aid the spread of weeds due to the movement and/or introduction of soil, vehicles and equipment. A Site Erosion and Sediment Control Plan or Soil Water Management Plan, in accordance with the Blue Book, is to be implemented for the Project.
<b>Conclusion</b>	The proposed actions are unlikely to result in the spread of invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.
<b>Criterion</b>	<b>viii. introduce disease that may cause the species to decline</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>The study area is potential infected with <i>Phytophthora cinnamomi</i></li> <li>Habitat disturbance may aid the spread of <i>Phytophthora</i>.</li> <li>Controls on the movement of vehicles, and human traffic into Duffys Forest vegetation habitat.</li> <li>Western Australian Conservation and Land Management guidelines for <i>Phytophthora cinnamomi</i> will be adopted to minimise infection to other areas.</li> <li>The proposed management controls for <i>Phytophthora</i> will reduce the risk of spread this pathogen.</li> </ul>
<b>Conclusion</b>	The proposed activity is unlikely to spread a pathogen with potential to cause these species to decline
<b>Criterion</b>	<b>ix. interfere substantially with the recovery of the species</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>No Recovery Plans has been prepared to consider the requirements for these species.</li> <li>However, threats that have been identified to interfere with the recovery of this species, which are relevant to the proposed activity include vegetation removal.</li> <li>Approximately 4.25 ha of DFEC will be removed.</li> <li>This vegetation type is of moderate to high importance to the long-term survival of this species.</li> </ul>
<b>Conclusion</b>	The proposed activity is likely to interfere with the recovery of these species.

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## **Overall Conclusion**

The proposed activity will permanently remove approximately 4.25 ha of remnant DFEC, which provides potential habitat for these species. However, despite targeted surveys, these species were not located within the study area. While it is unlikely these species are present, mitigation measures have been proposed to protect potential habitat and reduce threats. The proposed activity is unlikely to have a significant impact on these endangered and critically endangered species.

Referral to DSEWPaC is not required.

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## **Mitigation Measures**

- Retention of remnant of DFEC on former Blinking Light Reserve land to east of Bantry Bay Road.
  - Management of threats (weed invasion, inappropriate fire regimes and public access to habitat).
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**Species Name: *Isoodon obesulus* (Southern Brown Bandicoot)**

<b>Criterion</b>	<b>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:</b>
<b>Response</b>	<p><b>i. lead to a long-term decrease in the size of a population</b></p> <ul style="list-style-type: none"> <li>• The Southern Brown Bandicoot is listed as Endangered under the EPBC Act.</li> <li>• It has not been trapped in the study area, although there is evidence of dig characteristics to bandicoots in some areas of open grassland on site.</li> <li>• This species requires dense ground cover and low vegetation for nesting and shelter.</li> <li>• The site is highly modified.</li> </ul>
<b>Conclusion</b>	If this species is present the proposed action would remove the majority of foraging, nesting and breeding habitat within the study area.
<b>Criterion</b>	<b>ii. reduce the area of occupancy of the species</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Southern Brown Bandicoots occur over approximately 5000 km<sup>2</sup> and their area is reducing, with localised extinctions occurring in New South Wales.</li> <li>• All extant populations are considered to be important to the survival of this sub-species.</li> <li>• The site is highly modified and despite extensive trapping the species has never been detected on site.</li> <li>• Adjacent habitat could potentially provide better quality habitat for this species.</li> </ul>
<b>Conclusion</b>	It is unlikely that the proposed activities will result in a reduction in the area of occupancy of the southern brown bandicoot.
<b>Criterion</b>	<b>iii. fragment an existing population into two or more populations</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Extensive habitat removal from the study area will result in isolation of remnant vegetation surrounding the study area</li> <li>• Lack of connectivity and wildlife corridors in the area surrounding the study area</li> <li>• Low mobility of the Southern Brown Bandicoot</li> </ul>
<b>Conclusion</b>	The proposed activity may fragment an existing population into two or more populations if it were present on site.
<b>Criterion</b>	<b>iv. adversely affect habitat critical to the survival of a species</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• No critical habitat has been declared for this species</li> </ul>
<b>Conclusion</b>	The proposed activity is unlikely to adversely affect habitat critical to the survival of these species
<b>Criterion</b>	<b>v. disrupt the breeding cycle of a population</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Breeding season differs throughout this species geographical range and is linked to environmental factors and abundance of food resources.</li> <li>• Young remain in the pouch for at least two months, after which mortality rates rise (invasive predators, road kill etc.) and juveniles disperse.</li> </ul>

<b>Conclusion</b>	The site already has introduced predators (ie. foxes and cats) on site and is surrounded by roads. Any potential population on site would already have a disrupted breeding cycle with restricted access to breeding habitat. It is unlikely that the proposed works will disrupt the breeding cycle any further.
<b>Criterion</b>	<b>vi. modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The majority of foraging, nesting and breeding habitat within the study area will be removed as a result of the project.</li> <li>• The action proposed will affect continuity of habitat and wildlife corridors in the area</li> </ul>
<b>Conclusion</b>	The availability and quality of habitat will substantially decrease to the extent the southern brown bandicoot is likely to decline if the species was present within the study area. There is no evidence that there are located within the project area.
<b>Criterion</b>	<b>vii. result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Invasive species, including introduced predators and weed species, are already present on the study site.</li> <li>• Weed invasion is capable of degrading habitat complexity.</li> </ul>
<b>Conclusion</b>	It is unlikely that the proposed actions will result in additional invasive species becoming established in the area that are harmful to the Southern Brown Bandicoot.
<b>Criterion</b>	<b>viii. introduce disease that may cause the species to decline</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The study species is potentially infested with <i>Phytophthora cinnamomi</i>.</li> <li>• <i>Phytophthora</i> induces die-back of vegetation.</li> <li>• <i>Phytophthora</i> can affect Southern Brown Bandicoot through the loss of cover, food resources and nesting habitat.</li> <li>• Habitat disturbance may aid the spread of <i>Phytophthora</i>.</li> <li>• Controls on the movement of vehicles, and human traffic into Duffys Forest vegetation habitat.</li> <li>• Western Australian Conservation and Land Management guidelines for <i>Phytophthora cinnamomi</i> will be adopted to minimise infection to other areas.</li> <li>• The proposed management controls for <i>Phytophthora</i> will reduce the risk of spread this pathogen.</li> </ul>
<b>Conclusion</b>	The proposed activity is unlikely to spread a pathogen with potential to cause Southern Brown Bandicoot to decline.

<b>Criterion</b>	<b>ix. interfere with the recovery of the species</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Clearance/modification of understorey vegetation and high-quality habitat for urban, agricultural and pastoral purposes, isolation of populations through habitat fragmentation and invasive predators all negatively affect the Southern Brown Bandicoot.</li> <li>• Abatement of these key threats will be beneficial to the recovery of the species.</li> </ul>
<b>Conclusion</b>	Despite the fact that this project will require the removal of vegetation on site, it is not expected that this will adversely impact on the potential for the species to recover in this area, due to the fragmented habitat and the species not being detected within the study area.

### Overall Conclusion

Given the highly modified and disjunct habitat and the lack of Southern Brown Bandicoots being detected, it is unlikely that the proposed works will negatively impact upon these species, their habitats or their potential for recovery.

Referral to DSEWPac is not required

### Mitigation Measures

Assist in reducing key threatening processes e.g. predation by invasive carnivores, habitat disturbance and interactions with traffic.

Retain and protect wildlife corridors and increase access to corridor.

Follow protocol to prevent introduction or spread of *Phytophthora cinnamomi*. The protocols used should be either the Sydney Region Pest Management Strategy or Best Practice Guidelines for *Phytophthora cinnamomi* (DECC, 2008b).

**Species: *Phascolarctos cinereus* (Koala)**

<b>Criterion</b>	<b>An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:</b>
<b>Response</b>	<p><b>i. lead to a long-term decrease in the size of an important population of a species</b></p> <ul style="list-style-type: none"> <li>Habitat on the subject site is highly modified with only a small amount of feed tree species potentially available.</li> <li>No sign was identified of this species during surveys onsite and it is highly unlikely that a local population exists.</li> </ul>
<b>Conclusion</b>	The mature trees that are to be impacted as part of the proposed works are not considered to provide foraging resources suitable to sustain a local Koala population. Therefore the extent of koala habitat to be removed or modified is minor. The proposed works will not lead to a long-term decrease in the size of an important population.
<b>Criterion</b>	<b>ii. reduce the area of occupancy of an important population</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>Habitat on the subject site is highly modified with only a small amount of feed and shelter tree species potentially available.</li> <li>No sign was identified of this species during surveys onsite and it is highly unlikely that a local population exists.</li> </ul>
<b>Conclusion</b>	The mature trees that are to be impacted as part of the proposed works are not considered to provide foraging resources suitable to sustain a local Koala population. Therefore the extent of koala habitat to be removed or modified is minor. The proposed works will not reduce the areas of occupancy of an important population.
<b>Criterion</b>	<b>iii. fragment an existing important population into two or more populations</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>An important population has not been recorded within the study area</li> </ul>
<b>Conclusion</b>	Not applicable.
<b>Criterion</b>	<b>iv. adversely affect habitat critical to the survival of a species</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>Critical habitat has not been declared for this species.</li> </ul>
<b>Conclusion</b>	Not applicable.
<b>Criterion</b>	<b>v. disrupt the breeding cycle of an important population</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>Habitat on the subject site is highly modified with only a small amount of feed and shelter trees available.</li> <li>No sign was identified of this species during surveys onsite and it is highly unlikely that a local population exists.</li> <li>The area does not constitute critical habitat for breeding and the footprint of works is confined to a small area (&lt;10 ha).</li> </ul>
<b>Conclusion</b>	The proposed works will not disrupt the breeding cycle of an important population.

<b>Criterion</b>	<b>vi. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• This species has the ability to modify their home range depending on the quality and amount of food available within an area, capable of occupying home ranges of several hundred hectares.</li> <li>• The koala can move over open ground in search of food trees.</li> </ul>
<b>Conclusion</b>	Given the mobility of the species and the restricted habitat available on site, it is unlikely the proposed actions will change the availability and quality of habitat to the extent that this species will decline.
<b>Criterion</b>	<b>vii. result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The proposed works do not involve procedures that are likely to increase the potential for invasive species to be present if best practice techniques are employed.</li> </ul>
<b>Conclusion</b>	With adherence to best practice construction techniques and ongoing management, the project will not result in invasive species that are harmful to a vulnerable species becoming established in the species' habitat.
<b>Criterion</b>	<b>viii. introduce disease that may cause the species to decline</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The proposed works do not involve procedures that are likely to increase the potential for introduced diseases to be present if best practice techniques are employed.</li> </ul>
<b>Conclusion</b>	With adherence to best practice construction techniques and ongoing management, the project will not introduce disease that may cause the species to decline.
<b>Criteria</b>	<b>ix. interfere substantially with the recovery of the species</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The proposed works constitutes part of the key threatening process of 'clearing native vegetation', due to the small amount of feed trees occurring within the area of direct impact.</li> <li>• However, this remnant is unlikely to be important for the species in the region due to the limited amount of habitat in the locality.</li> </ul>
<b>Conclusion</b>	While a small amount of potential habitat will be cleared, mitigation measures recommend the retention of mature vegetation where possible. Therefore It is unlikely that the actions proposed will interfere substantially with the recovery of the species.

#### **Overall Conclusion**

The proposed development is not considered to negatively impact on the Koala. This is due to the low value of the potential habitat and high mobility of this species. In addition, no individuals have been recorded within the study area during surveys.

A referral to DSEWPaC is not required.

#### **Mitigation Measures**

Not applicable.



**Species: *Pteropus poliocephalus* (Grey-headed Flying-fox)**

<b>Criterion</b>	<b>An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:</b>
	<b>i. lead to a long-term decrease in the size of an important population of a species</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>Habitat on the site is highly modified with only a small amount of feed tree species and limited shelter tree species potentially available.</li> <li>No sign was identified of this species utilizing the study area and it is highly unlikely that a local population exists.</li> </ul>
<b>Conclusion</b>	The mature trees that are to be impacted as part of the proposed works are not considered to provide foraging resources suitable to sustain a local Grey-headed Flying-fox population. Therefore the extent of Flying-fox habitat to be removed or modified is minor. The proposed works will not lead to a long-term decrease in the size of an important population.
<b>Criterion</b>	<b>ii. reduce the area of occupancy of an important population</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>This species requires foraging resources and roosting sites. Roosting sites have large numbers of Grey-headed Flying-foxes congregating in large trees.</li> <li>No sign was identified of this species utilizing the study area and it is highly unlikely that a local population exists.</li> </ul>
<b>Conclusion</b>	The mature trees that are to be impacted as part of the proposed works are not considered to provide foraging resources suitable to sustain a Grey-headed Flying-fox population. Therefore the extent of habitat to be removed or modified is minor. The proposed works will not reduce the areas of occupancy of an important population.
<b>Criterion</b>	<b>iii. fragment an existing important population into two or more populations</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>Grey-headed Flying-foxes can travel up to 60-70 km per night in search of foraging resources and migrates in response to changes in amount and location of flowering vegetation</li> <li>No sign was identified of this species utilizing the study area and it is highly unlikely that a local population exists</li> <li>Some large trees will be retained on site adjacent to roadside vegetation which will limit further fragmentation of habitat.</li> </ul>
<b>Conclusion</b>	Given the restricted habitat available, this species ability to adapt foraging behaviour to resource availability and high level of mobility, it is highly unlikely that the proposed actions will result in the fragmentation of an existing important population of Grey-headed Flying-foxes.
<b>Criterion</b>	<b>iv. adversely affect habitat critical to the survival of a species</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>No critical habitat has been declared for this species.</li> </ul>
<b>Conclusion</b>	Not applicable.

<b>Criterion</b>	<b>v. disrupt the breeding cycle of an important population</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Following breeding, females relocate with young to maternal camps.</li> <li>• No roosting sites or maternal camps were identified on site.</li> <li>• No sign was identified of this species utilizing the study area and it is highly unlikely that a local population exists.</li> </ul>
<b>Conclusion</b>	Given that important resources for breeding are not available on site, it is highly unlikely that the proposed actions will disrupt the breeding cycle of an important population.
<b>Criterion</b>	<b>vi. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Habitat on the site is highly modified with only a small amount of feed tree species and limited shelter tree species potentially available</li> <li>• No sign was identified of this species utilizing the study area and it is highly unlikely that a local population exists</li> <li>• Grey-headed Flying-foxes can travel up to 60-70 km per night in search of foraging resources and migrates in response to changes in amount and location of flowering vegetation</li> </ul>
<b>Conclusion</b>	The proposed actions are highly unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline.
<b>Criterion</b>	<b>vii. result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The proposed works do not involve procedures that are likely to increase the potential for invasive species to be present if best practice techniques are employed.</li> </ul>
<b>Conclusion</b>	With adherence to best practice construction techniques and ongoing management, the project will not result in invasive species that are harmful to a vulnerable species becoming established in the species' habitat.
<b>Criterion</b>	<b>viii. introduce disease that may cause the species to decline</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• The proposed works do not involve procedures that are likely to increase the potential for introduced diseases to be present if best practice techniques are employed.</li> </ul>
<b>Conclusion</b>	With adherence to best practice construction techniques and ongoing management, the project will not introduce disease that may cause the species to decline.
<b>Criteria</b>	<b>ix. interfere substantially with the recovery of the species</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• An action plan has been developed and recovery strategies for the Grey-headed Flying-fox include abatement of threats such as habitat loss and fragmentation, competition and hybridisation, pollutants and pathogens.</li> </ul>
<b>Conclusion</b>	While a small amount of potential habitat will be cleared, It is unlikely that the actions proposed will interfere substantially with the recovery of the species.

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**Overall Conclusion**

The proposed development is not considered to negatively impact on the Grey-headed Flying-fox. This is due to the low value of the potential habitat and the lack of this species roosting or feeding within the study area.

A referral to DSEWPaC is not required.

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**Mitigation Measures**

Not applicable.

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**Species: *Pseudomys novaehollandiae* (New Holland Mouse)**

<b>Criterion</b>	<b>An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:</b>
	<b>i. lead to a long-term decrease in the size of an important population of a species</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• Despite extensive trapping within the study area, the New Holland Mouse has not been detected on site.</li> <li>• It has eight metapopulations, with the closest one located in Kuringai Chase National Park.</li> </ul>
<b>Conclusion</b>	It is unlikely that an important population exists on site or that the actions will lead to any long-term decrease.
<b>Criterion</b>	<b>ii. reduce the area of occupancy of an important population</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• It is unlikely that an important population exists on site.</li> <li>• The area of occupancy of this species estimated to be approximately 420 km<sup>2</sup></li> <li>• The actions will likely result in a loss of less than 6 hectares of potential habitat.</li> </ul>
<b>Conclusion</b>	It is unlikely that the proposed actions will result in a reduction of the area of occupancy of any important population.
<b>Criterion</b>	<b>iii. fragment an existing important population into two or more populations</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• It is unlikely an important population exists on site.</li> </ul>
<b>Conclusion</b>	Therefore it is unlikely that the proposed actions will fragment an existing important population.
<b>Criterion</b>	<b>iv. adversely affect habitat critical to the survival of a species</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• No critical habitat has been identified for this species.</li> </ul>
<b>Conclusion</b>	The actions will not adversely affect habitat critical to the survival of this species.
<b>Criterion</b>	<b>v. disrupt the breeding cycle of an important population</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• It is unlikely that an important population exists on site.</li> </ul>
<b>Conclusion</b>	The actions are unlikely to disrupt the breeding cycle of an important population.
<b>Criterion</b>	<b>vi. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• This species occurs across an area of approximately 90,000 km<sup>2</sup> and has approximately seven metapopulations in habitat of open woodland, open heathland and vegetated sand dunes</li> <li>• The area of habitat to be removed is less than 6 hectares and there is no evidence of this species within the study area.</li> </ul>
<b>Conclusion</b>	It is unlikely that the actions will alter the availability or quality of habitat to the extent that this species is likely to decline.

<b>Criterion</b>	<b>vii. result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>Invasive weed species and feral animals are currently present on the site.</li> </ul>
<b>Conclusion</b>	The actions are unlikely to result in invasive species that are harmful to the New Holland Mouse becoming established as it is likely the already are on site.
<b>Criterion</b>	<b>viii. introduce disease that may cause the species to decline</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>The proposed works do not involve procedures that are likely to increase the potential for introduced diseases to be present if best practice techniques are employed.</li> </ul>
<b>Conclusion</b>	With adherence to best practice construction techniques and ongoing management, the project will not introduce disease that may cause the species to decline.
<b>Criteria</b>	<b>interfere substantially with the recovery of the species</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>Threats to this species include habitat loss and modification, inappropriate fire regimes, predation and competition, climate change and a lack of understanding surrounding the ecology and response to disturbances.</li> </ul>
<b>Conclusion</b>	The actions are unlikely to exacerbate any of these threats to the extent that it will interfere with the recovery of the species.
<b>Overall Conclusion</b>	
The proposed actions are unlikely to negatively impact the New Holland Mouse.	
A referral to DSEWPaC is not required.	
<b>Mitigation Measures</b>	
Not required.	

**Species: *Heleioporus australiacus* (Giant Burrowing Frog)**

<b>Criterion</b>	<b>An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:</b>
	<b>i. lead to a long-term decrease in the size of an important population of a species</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• This species has not been detected in surveys conducted within the study area</li> <li>• The project area is likely to provide only sub-optimal habitat for the Giant Burrowing Frog, with only small ephemeral pools after rain and a lack of sandstone ridges</li> <li>• No important population has been identified on site.</li> </ul>
<b>Conclusion</b>	It is unlikely that the proposed actions will have a significant impact leading to a long-term decrease in the size of an important population.
<b>Criterion</b>	<b>ii. reduce the area of occupancy of an important population</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• There are no population estimates available for this species, but the northern population is largely confined to the sandstone geology around the Sydney Basin region</li> <li>• No important population has been identified on site.</li> </ul>
<b>Conclusion</b>	It is unlikely that the proposed actions will reduce the area of occupancy of an important population.
<b>Criterion</b>	<b>iii. fragment an existing important population into two or more populations</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• It is unlikely an important population exists on site.</li> </ul>
<b>Conclusion</b>	Therefore it is unlikely that the proposed actions will fragment an existing important population.
<b>Criterion</b>	<b>iv. adversely affect habitat critical to the survival of a species</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• No habitat critical to the survival of this species has been identified.</li> </ul>
<b>Conclusion</b>	The actions are unlikely to adversely affect habitat critical to the survival of a species.
<b>Criterion</b>	<b>v. disrupt the breeding cycle of an important population</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• It is unlikely that an important population exists on site</li> </ul>
<b>Conclusion</b>	The actions are unlikely to disrupt the breeding cycle of an important population.
<b>Criterion</b>	<b>vi. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>• This species is associated with sandstone ridges, sandy soils supporting heath vegetation in the northern part of its distribution, with a preference for semi-permanent or ephemeral streams</li> <li>• The area of habitat to be removed is less than 6 hectares of sub-optimal habitat and there is no evidence of this species within the study area.</li> </ul>
<b>Conclusion</b>	It is unlikely that the actions will alter the availability or quality of habitat to the extent that this species is likely to decline.

<b>Criterion</b>	<b>vii. result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>The proposed works do not involve procedures that are likely to increase the potential for invasive species to be present if best practice techniques are employed.</li> </ul>
<b>Conclusion</b>	With adherence to best practice construction techniques and ongoing management, the project will not result in invasive species that are harmful to a vulnerable species becoming established in the species' habitat.
<b>Criterion</b>	<b>viii. introduce disease that may cause the species to decline</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>The proposed works do not involve procedures that are likely to increase the potential for introduced diseases to be present if best practice techniques in regards to the spread of chytrid fungus are employed.</li> </ul>
<b>Conclusion</b>	With adherence to best practice construction techniques and ongoing management, the project will not introduce disease that may cause the species to decline.
<b>Criteria</b>	<b>ix. interfere substantially with the recovery of the species</b>
<b>Response</b>	<ul style="list-style-type: none"> <li>The recovery strategies for this species are still in the development stage, with priority actions to determine threats and species distribution as well as develop management strategies.</li> </ul>
<b>Conclusion</b>	It is unlikely that the clearance of less than 6 ha of sub-optimal habitat within the study area, where this species has not been detected, is unlikely to interfere with the recovery of this species.
<b>Overall Conclusion</b>	
The proposed actions are unlikely to negatively impact the Giant Burrowing Frog.	
A referral to DSEWPaC is not required.	
<b>Mitigation Measures</b>	
Not required.	





# Appendix 7

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Comparison with DFEC Final Determination,  
Duffys Forest Index, BioMetric type and  
SMCMA descriptions



The Final Determination of DFEC (NSW Scientific Committee 2011) listed 71 characteristic native species. Thirty-seven of the 71 characteristic species listed for DFEC were recorded in the study area.

### ***Duffys Forest Ecological Community Final Determination comparison***

Results of the diagnostic comparisons have been independently verified by an expert botanist, Teresa James (James 2013). James compared relevant features of vegetation on the study area to assess equivalence with criteria described for the DFEC in the current Final Determination (NSW Scientific Committee 2011) (**Table 15**). All key features of the DFEC are satisfied. Within better condition vegetation in the study area, more than 50 per cent of the species recorded from plots are characteristic species listed in the Final Determination.

**Table 17 Consistency of proposed hospital site with the Final Determination for Duffys Forest EC (after James, 2013)**

Key feature/paragraph of Final Determination	Duffys Forest EEC	Proposed hospital site
Geographical location (paragraph 2)	Northern Sydney	Yes, northern Sydney
Topographic location (paragraph 2)	Mostly on ridges, plateaus & upper slopes	Yes, ridge/plateau surface with gentle slopes in marginal parts of site
Geology (paragraph 2)	Hawkesbury Sandstone typically with shale and laminate lenses	Yes, relatively deep shale/laminate deposits in Hawkesbury sandstone outcropping at site
Soils (paragraph 2)	Laterite soils & those derived from shale and laminate lenses	Yes, clay loam to sandy loam with laterite and sandstone gravels or fragments
Vegetation Structure (paragraph 2)	Open-forest to woodland	Yes, open-forest to woodland
Characteristic species (paragraph 3)	73 characteristic species listed	Yes, good representation with 66% recorded from site
Characteristic canopy species (paragraph 3)	Angophora costata, Corymbia gummifera, Eucalyptus capitellata, E. sieberi, E. haemastoma,	Yes, all these species present
Floristic variability of sites (paragraph 4)	Species recorded in the community is much larger than in paragraph 3; species composition will be influenced by the size of the site and recent disturbance history	Additional species recorded from site also known from DF as listed in Smith & Smith (2000); disturbed areas e.g. fire or weed affected at site are not necessarily excluded from EEC.
Relevant information on the community (paragraph 7)	Several references provided.	Smith & Smith (2000) is listed as one of the key references

James (2013) lists the following key features used to identify the presence of Duffys Forest EC at the site:

- site is located in higher part of landscape associated with a sandstone plateau/ridge
- rock outcrop is absent across most of the site
- relatively deep clay-loam soils with ironstone and sandstone gravels or fragments
- floristics are consistent predominantly with Angophora-White Mahogany Forest form of Duffys Forest EC and Group B as described by Smith and Smith (2000)
- naturally occurring canopy species present are all typical or commonly found in Duffys Forest
- predominantly woodland vegetation structure
- 62 per cent of SMCMA positive diagnostic species present and 40 per cent of those identified in Table 4 of Smith & Smith (2000) based on complete species listing for the site
- Duffys Forest Index when applied to entire species list for site and compared to SSRW and SSGF is significantly higher for Duffys Forest
- 70 per cent of the total species recorded are listed as most frequently occurring species within Duffys Forest (Table 5 of Smith and Smith 2000)
- Relatively low proportion of typical “shale” species with clay-loving sandstone species more common.

### ***Duffys Forest Index***

The Duffys Forest Index (DFI) (Smith and Smith 2000) was used to test for the presence of DFEC on the study area (Table 18 and Figure 10). The DFI was developed to address the problem of distinguishing DFEC vegetation from the two other communities with which it is likely to be confused in the main part of its distribution; the Warringah Local Government Area - Sydney Sandstone Ridgetop Woodland (SSRW) and Sydney Sandstone Gully Forest (SSGF).

Floristic analysis of 30 stands of Duffys Forest vegetation, 13 stands of SSRW and 10 stands of SSGF was used to identify positive and negative diagnostic species for each of the three communities. The lists of diagnostic species were then used to calculate a Duffys Forest index for each site using the following formula:

$$DFI = \frac{100(x + (20 - y))}{40}$$

where

x = number of positive diagnostic Duffys Forest species recorded

y = number of negative diagnostic Duffys Forest species recorded

The value of the index ranges from 100 when all positive diagnostic species are present and all negative diagnostic species are absent, to 0 when the reverse is true. Similar indices were calculated for the other two communities, SSRW and SSGF.

The vegetation community that a particular stand of vegetation most closely resembles is then indicated by which of the three indices has the highest value. The method requires an extensive list of native species for the stand of vegetation in question, but does not require abundance data.

Area C vegetation plot results were borderline for DFEC with a DFI score of 52.5 but this was higher than the two alternative vegetation types in the DFI comparison table (Sydney Sandstone Ridgetop Woodland, SSRW - 37.5 and Sydney Sandstone Gully Forest, SSGF - 45). Plots in Areas A and B scored equally for DFEC and SSGF.

**Table 18 Duffys Forest Index values**

Sampling area / plot		Duffys Forest EC	Sydney Sandstone Ridge-top Woodland	Sydney Sandstone Gully Forest
Areas A,B &C	DFI	62.5	32.5	50
	formula	$100 \times (8 + (20-3)) / 40$	$100 \times (1 + (20-9)) / 40$	$100 \times (4 + (20 - 4)) / 40$
A1	DFI	50	42.5	50
	formula	$100 \times (1 + (20-1)) / 40$	$100 \times (0+ (20-3)) / 40$	$100 \times (2+ (20-2)) / 40$
B1	DFI	52.5	45	52.5
	formula	$100 \times (2 + (20-1)) / 40$	$100 \times (0 + (20-2)) / 40$	$100 \times (1 + (20-0)) / 40$
C1	DFI	55	37.5	47.5
	formula	$100 \times (2 + (20-0)) / 40$	$100 \times (0 + (20-5)) / 40$	$100 \times (0 + (20-1)) / 40$
Aquatic Dr - offset	DFI	57.5	47.5	42.5
	formula	$100 \times (3 + (20-0)) / 40$	$100 \times (0 + (20-1)) / 40$	$100 \times (0 + (20-3)) / 40$
C2	DFI	52.5	40	50
	formula	$100 \times (1 + (20-0)) / 40$	$100 \times (0 + (20-4)) / 40$	$100 \times (1 + (20-1)) / 40$
C3	DFI	50	45	55
	formula	$100 \times (1 + (20-1)) / 40$	$100 \times (1 + (20-3)) / 40$	$100 \times (2 + (20-0)) / 40$
B2	DFI	52.5	40	47.5
	formula	$100 \times (1 + (20-0)) / 40$	$100 \times (0 + (20-4)) / 40$	$100 \times (0 + (20-1)) / 40$
A2	DFI	52.5	35	52.5
	formula	$100 \times (2 + (20-1)) / 40$	$100 \times (0 + (20-6)) / 40$	$100 \times (2 + (20-1)) / 40$
A4	DFI	55	40	50
	formula	$100 \times (2 + (20-0)) / 40$	$100 \times (0 + (20-4)) / 40$	$100 \times (0 + (20-0)) / 40$
B3	DFI	55	40	45
	formula	$100 \times (2 + (20-0)) / 40$	$100 \times (0 + (20-4)) / 40$	$100 \times (0 + (20-2)) / 40$

Figure 10.1. Area A Plot 1 Post-fire Regrowth

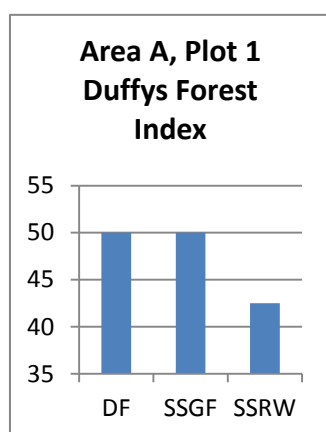


Figure 10.2. Area B Plot 1 Post-fire Regrowth Older Regrowth

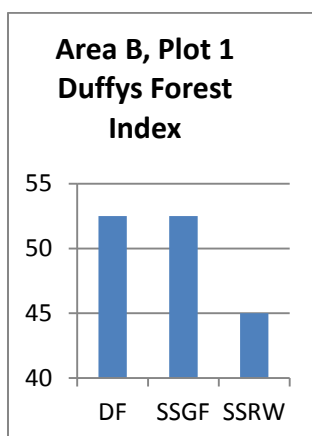


Figure 10.3. Area C Plot 1

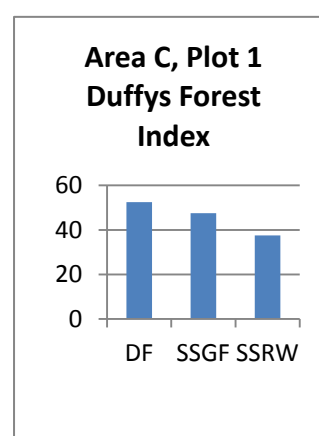


Figure 10.4. Area A Plot 4 Older Regrowth

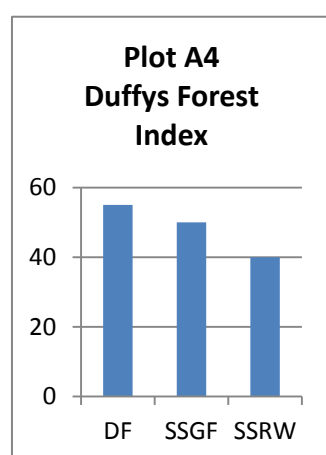


Figure 10.5. Area B Plot 2 Older Regrowth Older Regrowth

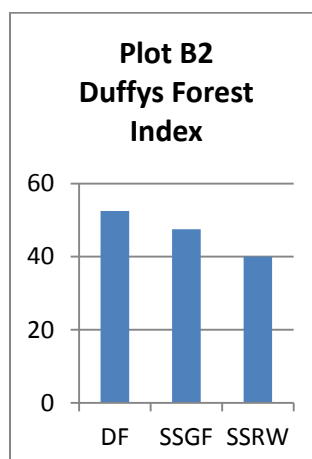


Figure 10.6. Area C Plot 2

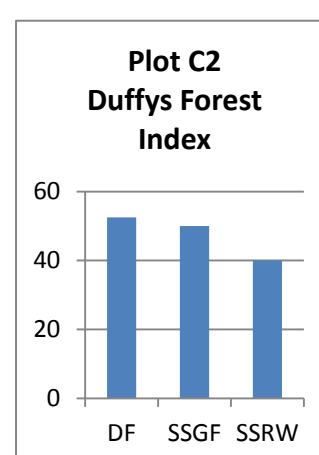


Figure 10.7. Area A Plot 2 Older Regrowth

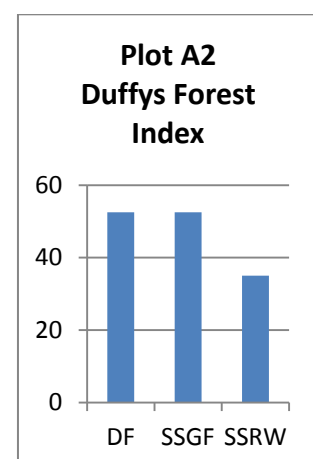


Figure 10.8. Area B Plot 3 Older Regrowth Older Regrowth

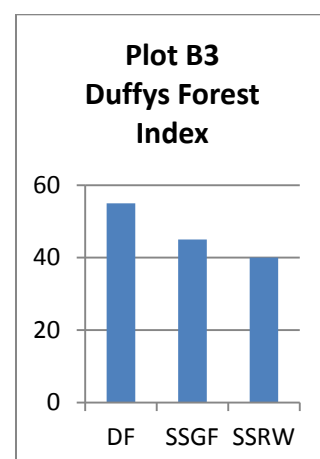
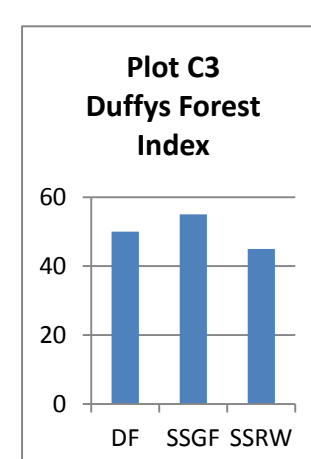


Figure 10.9. Area C Plot 3



**Figure 10 Duffys Forest Index Plots – Surveys 1 and 2**

## **SMCMA vegetation type diagnostic comparisons**

The classification of vegetation communities in the SMCMA vegetation mapping project (DECCW 2009) is based on quantitative analysis of a large set of floristic site data.

Candidate vegetation types were selected based information provided in the SMCMA vegetation community profiles, such as, dominant canopy species, together with a consideration of the distribution, soil, geology, landscape position, and vegetation structure (Appendix 2).

Lists of diagnostic species for each of six candidate SMCMA vegetation type were used to aide in plot-to-type assignment. The relative proportions of diagnostic species in each of the six candidate vegetation types were compared to find the best match for each plot.

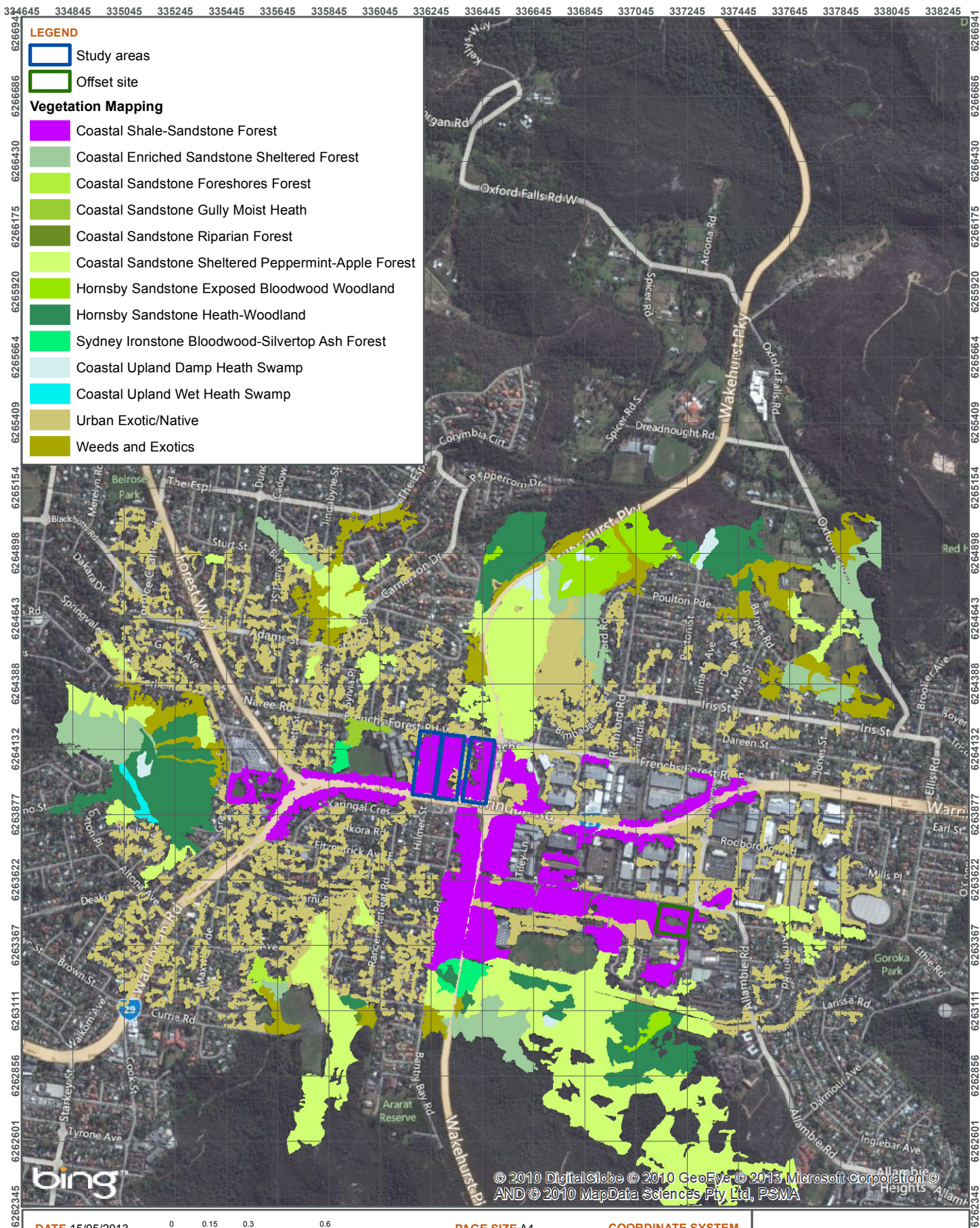
Diagnostic species are sorted into four fidelity classes: (i) positive (the species occurs more frequently in the target group than in all survey sites combined), and also include those that are only recorded within the target community irrespective of their frequency of detection or abundance; (ii) constant (the species occurs frequently in the target group and other groups, and is therefore characteristic rather than diagnostic of the target group); and (iii) uninformative (the species occurs less frequently and is recorded at lower abundance across all communities); (iv) negative (the species occurs in all other communities but is less common or abundant or not present at all in the target community). Species classed as negative diagnostic, species which had a group frequency of less than five per cent and uninformative species with group frequencies less than 10 per cent were not included in the SMCMA vegetation community profile lists (DECCW 2009).

The number of positive diagnostic species present in a sample can be used to identify the community type by ruling out all but a few feasible alternatives. This assumes that all vascular plant species occurring in the sample area were correctly identified and the total number of species recorded in the sample is close to the average number for the vegetation community (species-poor sites do not yield reliable results).

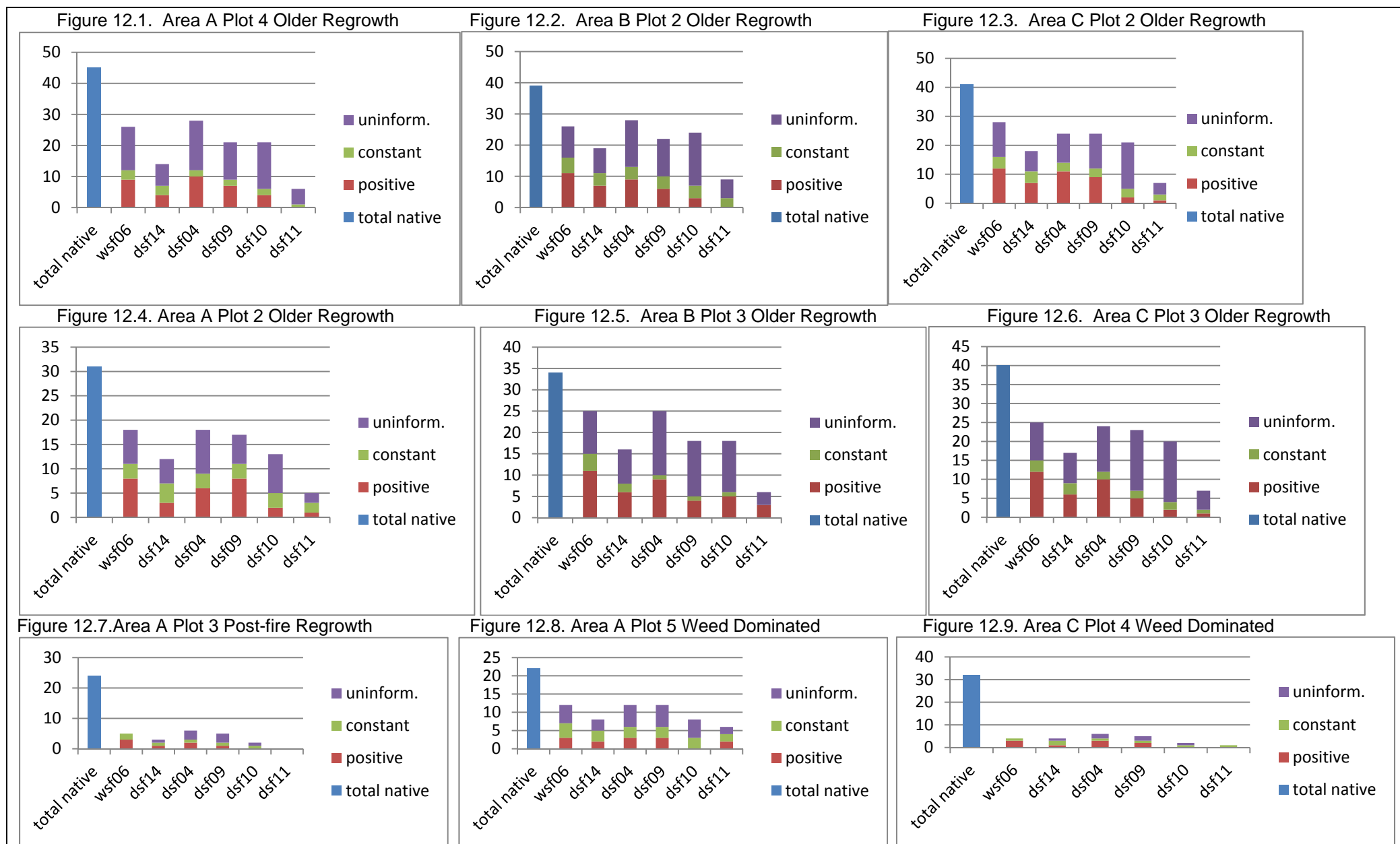
Results of systematic full-floristic sampling of nine plots surveyed in spring 2012 (Survey 2) were compared with positive diagnostic species for six candidate vegetation types. Duffys Forest Ecological Community (S\_DSFI4) was a poor match compared with both Coastal Enriched Sandstone Sheltered Forest and Coastal Shale-sandstone Forest in all plots sampled. Hornsby Sandstone Exposed Bloodwood Woodland (S\_DSFI1) was the poorest fit. Only two plots were used for the SMCMA analysis of this vegetation type. Comparisons with this vegetation type in future may yield different results as more plots are sampled and analysed.

Plots in weedy, disturbed areas yielded lower relative numbers of diagnostic species in all candidate vegetation types tested. Plot A5 is located on the path along the fence adjoining The Forest High School. This area is a long narrow 5 m to 10 m wide strip. Similarly, Plot C4 is a long narrow 10-15 m wide strip of (historically cleared and filled) land between remnant native vegetation in Area C and the houses (now removed) along Bantry Bay Road. Results from species-poor or highly disturbed, weedy sites such as these cannot be used for reliable diagnostic comparisons.









**Figure 12 Comparison of SMCMA diagnostics – fidelity classes and relative proportions of positive diagnostic species in candidate vegetation types, Survey 2**

### **SMCMA profile comparisons**

The disturbance history of the site is likely to have an influence on the reliability of using diagnostic species from plot data to assign vegetation type. Vegetation in disturbed areas was dominated by widespread common species. In addition plots located on ecotones (such as between CSSF and DFEC on the site) may account for inconclusive or marginal results (Oliver *et al* 2012).

James (2013) states that ‘the SMCMA profiles for Duffys Forest EC and other communities are not complete representations of those communities’ since the analysis is based on a selection of sites across the community with survey limited to a 20 m x 20 m plot at each site, and concludes that the DFI can be used more reliably in this way to assist in community identification at the site.

The adequacy of SMCMA site sampling for Coastal Shale-Sandstone Forest is also questioned by James (2013) since it is a ‘newly described’ community. James (2013) comments that no sites are understood to have been surveyed on higher plateau or ridge areas of Frenchs Forest for the SMCMA project (DEECW 2009) indicating that mapping of Coastal Shale-sandstone Forest at the site and surrounds (as shown in the SMEC report) is likely to be predictive.

However, 21 of the 32 sites recorded by Smith and Smith (2000) in the comprehensive survey and analysis of DFEC were used in the SMCMA analysis (including one site in Area C and one site within 100 metres of the study area (in bushland on the eastern side of Wakehurst Parkway) and two sites in bushland on Aquatic Drive approximately 300 metres and 500 metres from the study area. The quantitative analysis undertaken for the SMCMA mapping project (DECC 2009) groups these sites into Coastal Shale-sandstone Forest based on relevant site data and thus is more reliable than purely predictive mapping.

The identification of Coastal Shale-sandstone Forest on the study area is also consistent with the SMCMA description of soil and landscape characteristics of this community with clay (1-2 metres thick) and deep ironstone bands in weathered shale (3–5 metres thick) across the southern part of the site (Douglas Partners 2012). Sydney Ironstone Bloodwood-Silvertop Ash Forest (S\_DSFI4) grades into Coastal Shale-Sandstone Forest (S\_VSF06), where ironstone deepens and erodes to clay soil (DECC 2009).

The current conservation status of the newly identified vegetation community type, Coastal Shale-sandstone Forest, is currently undetermined. Coastal Shale-sandstone Forest shares many species and other soil and landscape characteristics with the TSC Act listed EEC Shale Sandstone Transition Forest. A revised Shale Sandstone Transition Forest listing under the EPBC Act is currently under review and Coastal Shale-Sandstone Forest is likely to be considered as part of that review (pers. comm. James 2013).

As a result of the diagnostic comparisons James (2012) concluded that:

- Any intergrading areas with CSSF (in the south of the site) are considered part of the Duffys Forest EEC
- 2.4 ha of moderate condition remnant vegetation in the older regrowth ESU on the study area is Duffys Forest EEC

- 2.35 ha of vegetation in the post-fire regrowth ESU should also be classified as Duffys Forest EEC. The post-fire regrowth is patchy in composition and condition probably reflecting a mosaic of disturbance influences
- 1.7 ha of weed dominated vegetation, mainly around the margins of the site has remnant canopy species and some midstorey species consistent with DFEC and should also be included in DFEC on the study area.

Bearing in mind the caveats that apply to diagnostic tests for determining vegetation type, the identification of vegetation on the study area is provisional. The vegetation community types may need to be revised if more information comes to hand in future surveys that supports reclassification of vegetation types in the SMCMA.

Thus, the conservation significance ranking of the study area (and nearby surrounding vegetation) as assessed in the Warringah Biodiversity Conservation Study (Ecological 2011) is likely to remain high regardless of which vegetation types (Duffys Forest EC, Coastal Shale-sandstone Forest or intergrades of both) are determined to be on the site.



# Appendix 8

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## Anabat echolocation call analysis report (summer 2013)



## Introduction

This appendix contains the analysis of the Anabat echolocation calls captured during the summer 2013 survey.

## Reference library

Bat calls were analysed using the program AnalookWV. Identifications were made using a regional based guide to the echolocation calls of microbats in New South Wales NSW (Pennay *et al* 2004) and the accompanying reference library of bat calls from the Sydney area.

## Survey effort and identification rate summary

A total of 45 call sequences were recorded over three nights, from 18 to 22 February 2013. Details of the survey effort and locations are shown in Table 19.

**Table 19 Summary of Anabat echolocation detection**

Date	Time	Location	Description of location
18-19 Feb 2013	17.32 to 07.22	Transect A	A narrow walking track, surrounded by a fence to the west; dense vegetation to the east and overhanging canopy vegetation above.
19-20 Feb 2013	18.08 to 08.36	Transect A	As above
21-22 Feb 2013	09.07 to 14.34	Transect C	An open, grassed area with scattered trees, surrounded by a fence to the west and open woodland vegetation to north, east and south.

To ensure reliable and accurate results the following were followed:

- Recordings containing less than three pulses were not analysed (Law *et al* 1999)
- Only search phase calls were analysed (McKenzie *et al* 2002)
- Three categories of confidence in species identification were used (adapted from Mills *et al* 1996):
  - definite – identity not in doubt
  - probable – low probability of confusion with species of similar calls
  - possible – medium to high probability of confusion with species with similar calls.

As such, 18 (40%) of the sequences could be identified confidently to species or genus level (see Table 20).

**Table 20 Summary of Anabat echolocation identification**

Date	Confidence <sup>1</sup>	Species scientific name	Species common name
19 Feb 2013	Possible	<i>Vespedalus vulturnus</i>	Little Forest Bat
21 Feb 2013	Possible	<i>Vespedalus vulturnus</i>	Little Forest Bat
21 Feb 2013	Possible	<i>Vespedalus vulturnus</i> or <i>Chalinolobus morio</i>	Little Forest Bat or Chocolate Wattled Bat
21 Feb 2013	Possible	<i>Chalinolobus morio</i>	Little Forest Bat or Chocolate Wattled Bat
21 Feb 2013	Probable	<i>Vespedalus vulturnus</i>	Little Forest Bat
21 Feb 2013	Possible	<i>Vespedalus vulturnus</i> or <i>Chalinolobus morio</i>	Little Forest Bat or Chocolate Wattled Bat
21 Feb 2013	Probable	<i>Vespedalus vulturnus</i>	Little Forest Bat
21 Feb 2013	Probable	<i>Vespedalus vulturnus</i>	Little Forest Bat
21 Feb 2013	Possible	<i>Vespedalus vulturnus</i> or <i>Chalinolobus morio</i>	Little Forest Bat or Chocolate Wattled Bat
21 Feb 2013	Possible	<i>Vespedalus vulturnus</i>	Little Forest Bat
21 Feb 2013	Possible	<i>Vespedalus vulturnus</i>	Little Forest Bat
21 Feb 2013	Possible	<i>Vespedalus vulturnus</i>	Little Forest Bat
21 Feb 2013	Possible	<i>Vespedalus vulturnus</i>	Little Forest Bat
21 Feb 2013	Possible	<i>Vespedalus vulturnus</i>	Little Forest Bat
22 Feb 2013	Probable	<i>Vespedalus vulturnus</i>	Little Forest Bat
22 Feb 2013	Possible	<i>Vespedalus vulturnus</i>	Little Forest Bat
22 Feb 2013	Possible	<i>Vespedalus vulturnus</i>	Little Forest Bat
22 Feb 2013	Possible	<i>Vespedalus vulturnus</i>	Little Forest Bat

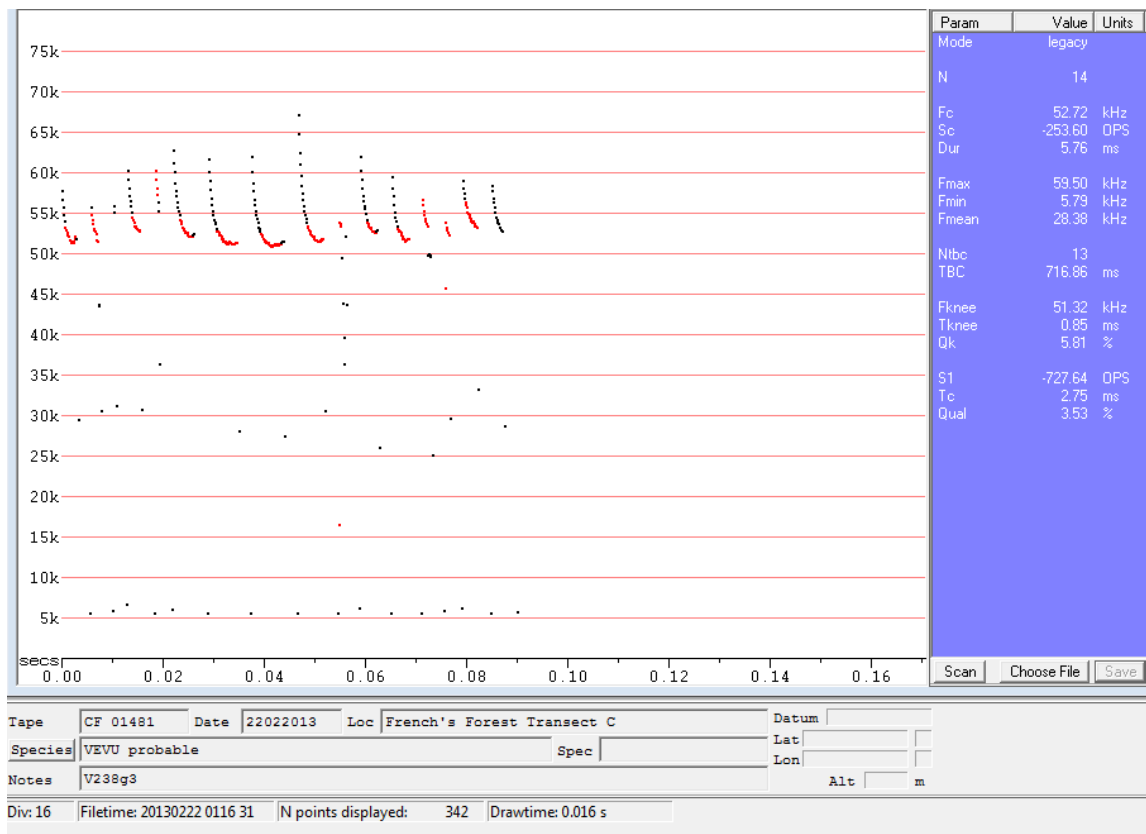
<sup>1</sup>Confidence: Possible = medium to high probability of confusion with species with similar calls, Probable = low probability of confusion with species of similar calls

### Example sequences

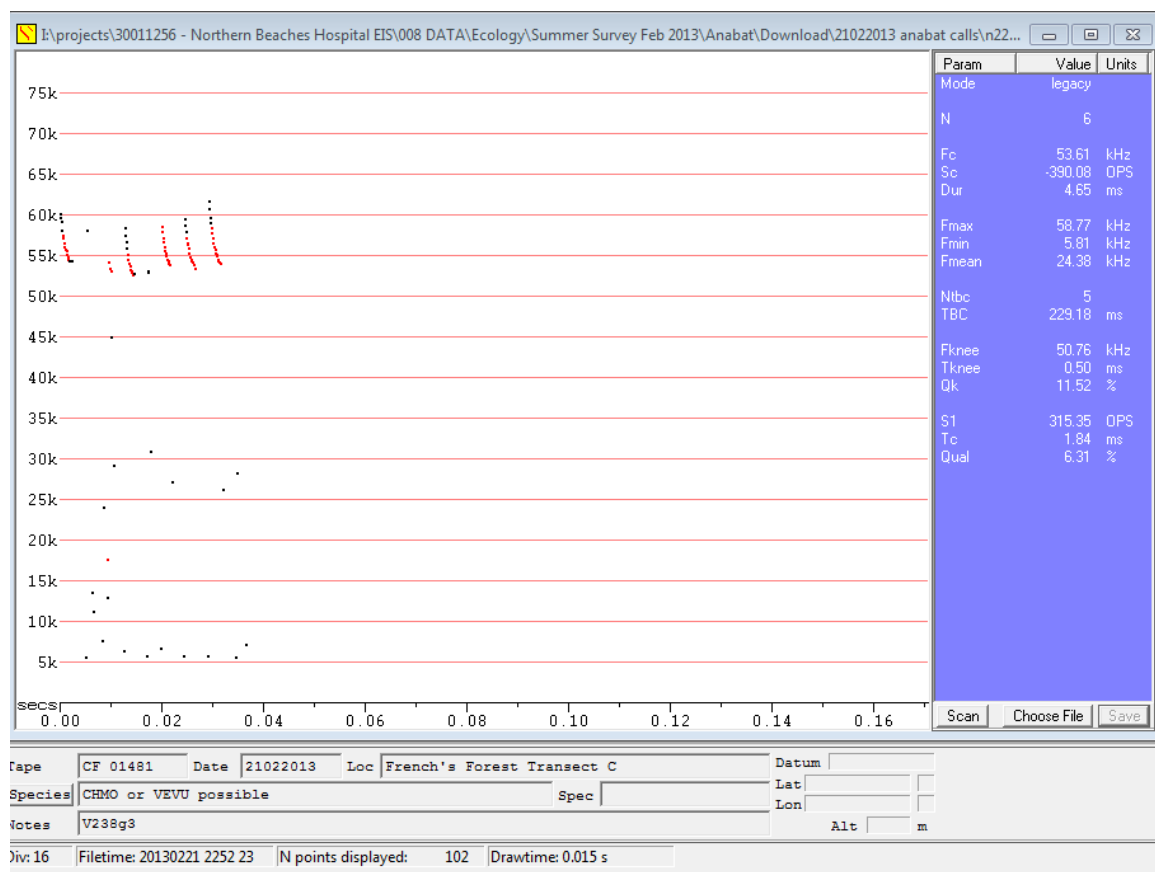
The call of one species, *Vespedalus vulturnus* (Little Forest Bat), was identified to a probable level. An example of a call of this species identified to this level at this survey is shown in **Figure 13**.

On four occasions, calls were identified as belonging either to *Vespedalus vulturnus* or *Chalinolobus morio* (Chocolate Wattled Bat). These species both have similar characteristic frequencies in the Sydney Basin area, however calls from *Chalinolobus morio* has a down-sweeping tail, whereas *Vespedalus vulturnus* has an up-sweeping or no tail (Pennay *et al* 2004). On the four occasions where calls were identified as belonging either to *Vespedalus vulturnus* or *Chalinolobus morio*, the calls contained up-sweeping and down-sweeping tails (see **Figure 14**).





**Figure 13 Example of *Vesedalus vulturnus* sequence**



**Figure 14** Example of *Vesedalus vulturus* or *Chalinolobus morio* sequence







**SMEC**

**ENVIRONMENT**