

A stylized topographic map with green contour lines is positioned on the left side of the page, extending from the top left towards the bottom left.

Sydney Swans Headquarters, Moore Park Biodiversity Development Assessment Report

APP Corporation Pty Limited

DOCUMENT TRACKING

Project Name	Sydney Swans Headquarters BDAR
Project Number	19SUT - 12417
Project Manager	Belinda Failes
Prepared by	Belinda Failes, Carolina Mora and Kirsten Velthuis
Reviewed by	Nicole McVicar and Meredith Henderson
Approved by	Beth Medway
Status	Final
Version Number	2
Last saved on	10 March 2020

This report should be cited as 'Eco Logical Australia. 2020 Sydney Swans Headquarters BDAR. Prepared for APP Corporation Pty Limited.'

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from Anthony Murphy from APP

Disclaimer

This document may only be used for the purpose for which it was commissioned and in accordance with the contract between Eco Logical Australia Pty Ltd and APP Corporation Pty Limited. The scope of services was defined in consultation with APP Corporation Pty Limited, by time and budgetary constraints imposed by the client, and the availability of reports and other data on the subject area. Changes to available information, legislation and schedules are made on an ongoing basis and readers should obtain up to date information. Eco Logical Australia Pty Ltd accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report and its supporting material by any third party. Information provided is not intended to be a substitute for site specific assessment or legal advice in relation to any matter. Unauthorised use of this report in any form is prohibited.

Template 2.8.1

Executive Summary

Eco Logical Australia Pty Ltd (ELA) was engaged by APP Corporation Pty Limited to prepare a Biodiversity Development Assessment Report (BDAR) for the proposed adaptive reuse of the Royal Hall of Industries for a high-performance sport and community facility in Moore Park, Sydney (the development site). The proposed redevelopment will be assessed as a State Significant Development (SSD-9726) consistent with the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The Secretary's Environmental Assessment Requirements (SEARs) have been issued and require the preparation of a BDAR under the NSW *Biodiversity Conservation Act 2016* (BC Act).

The proposed development will impact upon biodiversity values therefore a BDAR is required to assess the clearing of vegetation and modification of human-made structures under the BC Act. This report has been prepared to meet the requirements of the Biodiversity Assessment Method 2017 (BAM) established under Section 6.7 of the BC Act. State Environmental Planning Policy 47 – Moore Park Showground (SEPP 47) applies to the development site and has been addressed in this document. Due to the SEPP 47 zoning, the requirements of the Sydney Local Environmental Plan 2012 (LEP) do not apply. The *Development Control Plan 2012* (DCP) has been reviewed for additional legislative requirements.

The vegetation within the development site contains a small area of planted native (0.009 ha) and exotic vegetation (0.002 ha). Under BAM, all vegetation native to NSW must be assigned a Plant Community Type (PCT). Where native vegetation has been planted and does not clearly conform to any PCT, a 'best-fit' PCT must be assigned. Based on the available data, it was considered that the planted native vegetation could be assigned to PCT 1776 *Smooth-barked Apple - Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast*. This PCT does not correspond to a threatened ecological community listed under the BC Act or Commonwealth *Environment Protection Biodiversity Conservation Act 1999*.

During the field survey, potential habitat for microbats was assessed. Targeted survey was conducted for microbats which may utilise the roof cavities of buildings for roosting habitat. One threatened microbat species, *Miniopterus orianae oceanensis* (Large Bent-winged Bat) and possibly three non-threatened microbat species were recorded outside the Royal Hall of Industries building during acoustic detection surveys and one likely microbat (species not identified) was recorded emerging from a roof cavity of the building on thermal imaging camera. The Large Bent-winged Bat is a dual candidate species; ecosystem species for foraging habitat and species credit for breeding habitat (i.e. specific maternity caves). The development site does not contain caves and this species was assessed for prescribed impacts under section 9.2 of BAM. A Microbat Management Plan (MMP) has been prepared for implementation prior to, during and post-construction; this plan includes roost exclusions, bat box installation, and adaptive management procedures.

No other threatened fauna or threatened flora species were recorded within the development site. There is potential that highly mobile fauna species may utilise the vegetation for foraging resources on occasion. Consideration has been given to these highly mobile species during the preparation of this BDAR.

Measures taken to avoid, minimise and mitigate impacts to the vegetation and species habitat present within the development site and methodologies to minimise impacts during construction and operation of the development have been included in this BDAR.

Following consideration of all the above aspects, the residual unavoidable impacts of the project were calculated consistent with BAM by utilising the Biodiversity Assessment Method Credit Calculator (BAMC). For PCT 1176 the BAMC calculated a vegetation integrity score of 3.7. Under the BAM, no ecosystem credits are required to offset the removal of native vegetation if the vegetation integrity score is less than or equal to a score of 20.

One Matter of National Environmental Significance (MNES) was identified as having potential to be adversely affected by the proposed action: *Pteropus poliocephalus* (Grey-headed Flying-fox) is listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and it is considered that this species is likely to occasionally use the planted vegetation within the development site for foraging. Application of the Commonwealth Significant Impact Criteria was undertaken for the Grey-headed Flying-fox and concluded that the proposed action would not have a significant effect on this species.

Contents

1. Stage 1: Biodiversity assessment	1
1.1 Introduction	1
1.1.1 General description of the development site	1
1.1.2 Development site footprint	1
1.1.3 Sources of information used	2
1.2 Legislative context	6
1.3 Landscape features	8
1.3.1 Interim Biogeographic Regionalisation for Australia (IBRA) regions and subregions	8
1.3.2 Mitchell Landscapes	8
1.3.3 Native vegetation extent	8
1.3.4 Rivers and streams	8
1.3.5 Wetlands	8
1.3.6 Connectivity features	8
1.3.7 Areas of geological significance and soil hazard features	9
1.3.8 Site context	9
1.4 Native vegetation	9
1.4.1 Survey effort	9
1.4.2 Plant Community Types present	10
1.4.3 PCT selection justification	12
1.4.4 Vegetation integrity assessment	14
1.5 Threatened species	17
1.5.1 Ecosystem credit species	17
1.6 Species credit species	22
1.6.1 Targeted surveys	22
2. Stage 2: Impact assessment (biodiversity values)	30
2.1 Avoiding impacts	30
2.1.1 Locating and designing a project to avoid and minimise impacts on vegetation and habitat	30
2.1.2 Prescribed biodiversity impacts	31
2.2 Assessment of Impacts	35
2.2.1 Direct impacts	35
2.2.2 Change in vegetation integrity	35
2.2.3 Indirect impacts	35
2.2.4 Prescribed biodiversity impacts	36
2.2.5 Mitigating and managing impacts	38
2.2.6 Serious and Irreversible Impacts (SAII)	42
2.3 Risk assessment	42
2.4 Adaptive management strategy	43

2.5 Impact summary	46
2.5.1 Serious and Irreversible Impacts (SAII)	46
2.5.2 Impacts requiring offsets	46
2.5.3 Impacts not requiring offsets	46
2.5.4 Areas not requiring assessment.....	46
2.5.5 Credit summary	46
2.6 Consistency with legislation and policy	50
2.6.1 <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act)	50
2.6.2 Sydney Local Environmental Plan 2012 (LEP)	52
2.6.3 State Environmental Planning Policy (SEPP) No 47 - Moore Park.....	52
2.6.4 Sydney Development Control Plan 2012 (DCP)	52
3. References	54
Appendix A: Definitions.....	56
Appendix B: Vegetation plot data	59
Appendix C: Microbat Survey Report	61
Appendix D: Microbat Management Plan.....	62
Appendix E: Biodiversity credit report.....	63

List of Figures

Figure 1: Site Map	3
Figure 2: Location Map.....	4
Figure 3: Development site footprint.....	5
Figure 4: Plant Community Types and habitat features.....	15
Figure 5: Vegetation zone and plot location	16
Figure 6: Microbat anabat and thermal imaging camera survey locations	29
Figure 7: Final project footprint including construction and operation	45
Figure 8: Impacts not requiring offset.....	48
Figure 9: Areas not requiring assessment	49

List of Tables

Table 1: Legislative context	6
Table 2: IBRA regions.....	8
Table 3: IBRA subregions.....	8
Table 4: Mitchell Landscapes	8
Table 5: Native vegetation extent.....	8
Table 6: Connectivity features	9
Table 7: Percent native vegetation cover in the landscape	9
Table 8: Full-floristic PCT identification plots.....	10

Table 9: Vegetation Zones.....	10
Table 10: Plant Community Types.....	10
Table 11: PCT selection justification	13
Table 12: Vegetation integrity.....	14
Table 13: Justification for exclusion of predicted ecosystem credit species	18
Table 14: Justification for exclusion of species credit species	23
Table 15: Locating and designing a project to avoid and minimise impacts on vegetation and habitat.....	30
Table 16: Survey dates	32
Table 17: Weather conditions	32
Table 18: Microbat species recorded during acoustic call detection surveys	32
Table 19: Prescribed biodiversity impacts	33
Table 20: Locating and designing a project to avoid and minimise prescribed biodiversity impacts.....	34
Table 21: Direct impacts to native vegetation	35
Table 22: Change in vegetation integrity	35
Table 23: Indirect impacts	35
Table 24: Direct impacts on prescribed biodiversity impacts	36
Table 25: Measures proposed to mitigate and manage impacts.....	38
Table 26: Likelihood criteria	42
Table 27: Consequence criteria.....	42
Table 28: Risk matrix	43
Table 29: Risk assessment.....	43
Table 30: Impacts to vegetation not requiring offsets.....	46
Table 31: Ecosystem credits required	47
Table 32: EPBC Act of Significance for <i>Pteropus poliocephalus</i> (Grey-headed Flying-fox)	50
Table 33: Vegetation integrity data (Composition, Structure and function)	59
Table 34: Change in vegetation integrity scores for each management zone.....	59
Table 35: Species matrix (species recorded by plot).....	59
Table 36: Species matrix (species recorded during a traverse of the study area)	60

List of Photos

Photo 1: Royal Hall of Industries looking east from Driver Avenue.....	11
Photo 2: Vegetation zone 1 - <i>PCT 1776 Smooth-barked Apple-Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast_planted</i>	11
Photo 3: Exotic vegetation along Lang Road to be trimmed during the removal of the wall. Note the Jacaranda tree in background contains a tree hollow	12

Abbreviations

Abbreviation	Description
BAM	Biodiversity Assessment Method
BAMC	Biodiversity Assessment Method Credit Calculator
BC Act	NSW <i>Biodiversity Conservation Act 2016</i>
BDAR	Biodiversity Development Assessment Report
DCP	Development Control Plan
DoEE	Commonwealth Department of the Environment and Energy
DPIE	NSW Department of Planning, Industry and Environment (previously known as NSW Department of Planning and Environment, DPE)
EEC	Endangered Ecological Community
EES	NSW Environment, Energy and Science (previously known as NSW Office of Environment and Heritage, OEH)
ELA	Eco Logical Australia Pty Ltd
EP&A Act	NSW <i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
FM Act	NSW <i>Fisheries Management Act 1994</i>
GIS	Geographic Information System
GPS	Global Positioning System
IBRA	Interim Biogeographic Regionalisation for Australia
LGA	Local Government Area
LEP	Local Environmental Plan
LLS	Local Land Service
MMP	Microbat Management Plan
NSW	New South Wales
OEH	Office of Environment and Heritage (now part of DPIE)
PCT	Plant Community Type
RHI	Royal Hall of Industries
SAII	Serious and Irreversible Impacts
SEPP	State Environmental Planning Policy
SSD	State Significant Development
TEC	Threatened Ecological Community
VIS	Vegetation Information System
WM Act	NSW <i>Water Management Act 2000</i>

1. Stage 1: Biodiversity assessment

1.1 Introduction

This Biodiversity Development Assessment Report (BDAR) has been prepared to satisfy the comments made by the Environment, Energy and Science Group (EES) in response to the Environmental Impact Assessment (EIA) made for the proposed Adaptive Reuse of the Royal Hall of Industries, a State Significant Development (SSD-9726). This BDAR was prepared by Carolina Mora, Belinda Failes (BAAS18159) and Kirsten Velthuis (BAAS 19048); and has been peer reviewed by Nicole McVicar (BAAS18077) and Dr Meredith Henderson (BAAS17001), accredited persons under the BC Act.

1.1.1 General description of the development site

The proposed development site, defined as the area of land that is subject to the proposed development application, is approximately 1.07 ha in size.

The proposed development site is located at 1 Driver Avenue, Moore Park at Lot 100 DP 1246842. The site is owned by the Centennial Park and Moore Park Trust and is leased to the Sydney Swans for the purposes of the development.

The proposed development relates to the Royal Hall of Industries (RHI) building, and the associated courtyard area to the immediate south of the building. The proposed development site is located in the south-western corner of the Entertainment Quarter precinct and has a direct frontage to Driver Avenue to the west, Lang Road to the south and Errol Flynn Boulevard to the east, an access road within the Entertainment Quarter precinct.

The development site has been subject to considerable vegetation disturbance as a result of historical use of the grounds. No remnant native trees or ground cover species are present within the development site. Vegetated areas of the development site consist of planted trees and shrubs and hardstand areas.

This report includes two base maps, the Site Map (Figure 1) and the Location Map (Figure 2). The development site construction footprint is provided in Figure 3.

1.1.2 Development site footprint

The application seeks approval for the proposed adaptive reuse of the RHI for a high-performance sport and community facility. The development will maintain the structural integrity and façade of the RHI, whilst re-purposing the interior of the building to support a number of compatible uses and utilise the space effectively. In addition to the repurposing of the RHI, an extension of the building will be constructed to the south of the building in the current service and courtyard area and will include a pool and a netball centre.

Four *Corymbia maculata* (Spotted Gum) trees are proposed to be removed as part of this proposal. Exotic trees, *Liquidambar styraciflua* (Liquidambar) and *Jacaranda mimosifolia* (Jacaranda) will be pruned for the construction works on the existing brick wall along the southern boundary. The development site footprint is shown in Figure 3.

1.1.3 Sources of information used

The following data sources were reviewed as part of this report:

- BioNet Vegetation Classification System (VIS) (accessed on 21 October 2019)
- BioNet / Atlas of NSW Wildlife 5 km database search (DoPIE 2019)
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool 5 km database search (DotEE 2019)
- Threatened Biodiversity Data Collection (DoPIE 2019)
- NSW Government Biodiversity Values Map (accessed on 21 October 2019)
- The Native Vegetation of the Sydney Metropolitan Area (Office of Environment and Heritage (OEH) 2013)
- Additional GIS datasets including soil, topography, geology and drainage Arcadia Landscape Architecture – Sydney Swans HQ & Hordern Plaza Masterplan (October 2019)
- Allied Tree Consultancy – Addendum arborist report 2019
- Request for Secretary's Environmental Assessment Requirements
- Environmental Impact Statement Sydney Swans high performance sports facility (Urbis 2019)
- Sydney Swans Head Quarters Microbat Survey Report – Royal Hall of Industries – Prepared for APP, on behalf of the Sydney Swans (ELA 2020).
- Sydney Swans Head Quarters Landscape Development Application (Arcadia 2019)

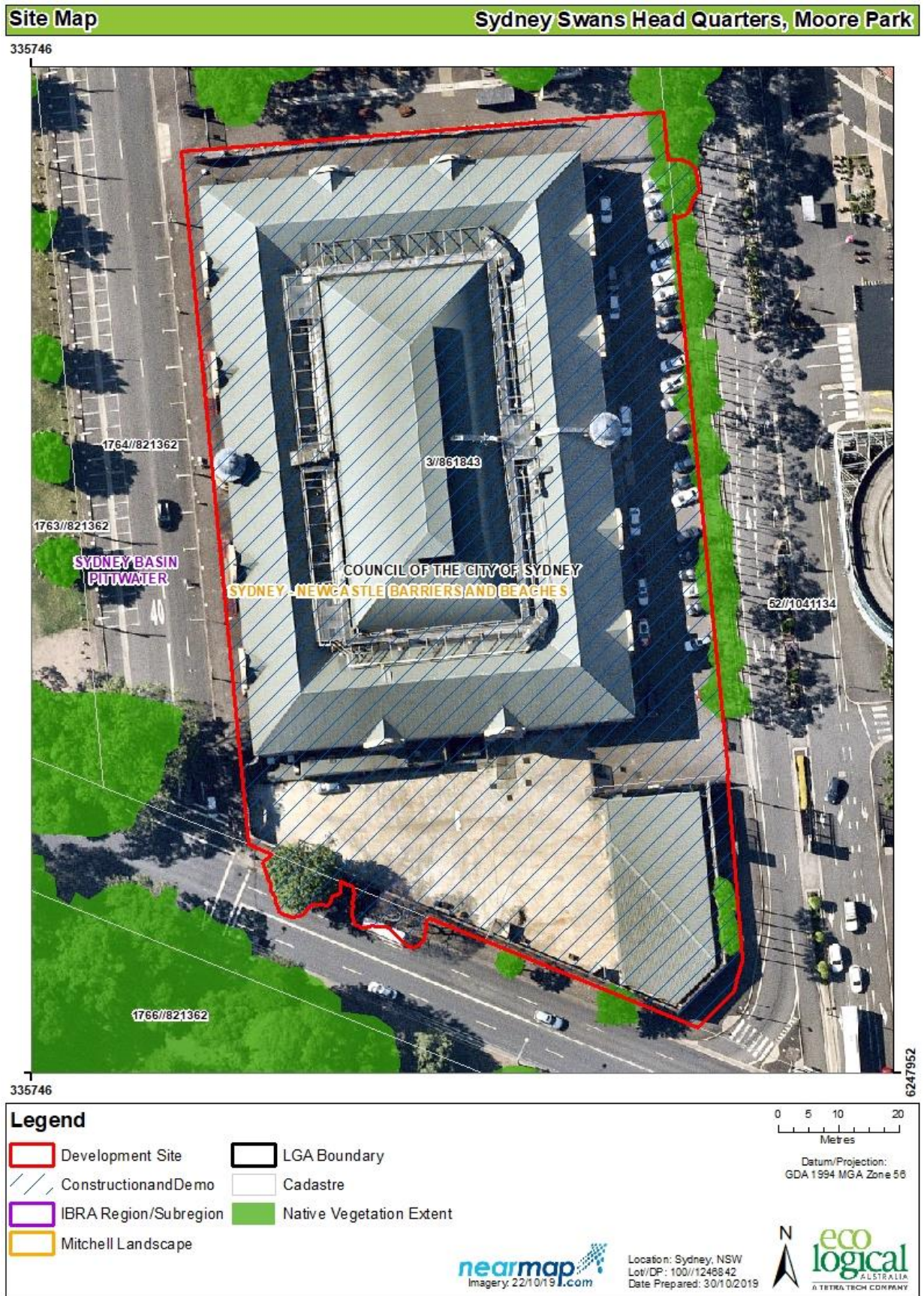


Figure 1: Site Map

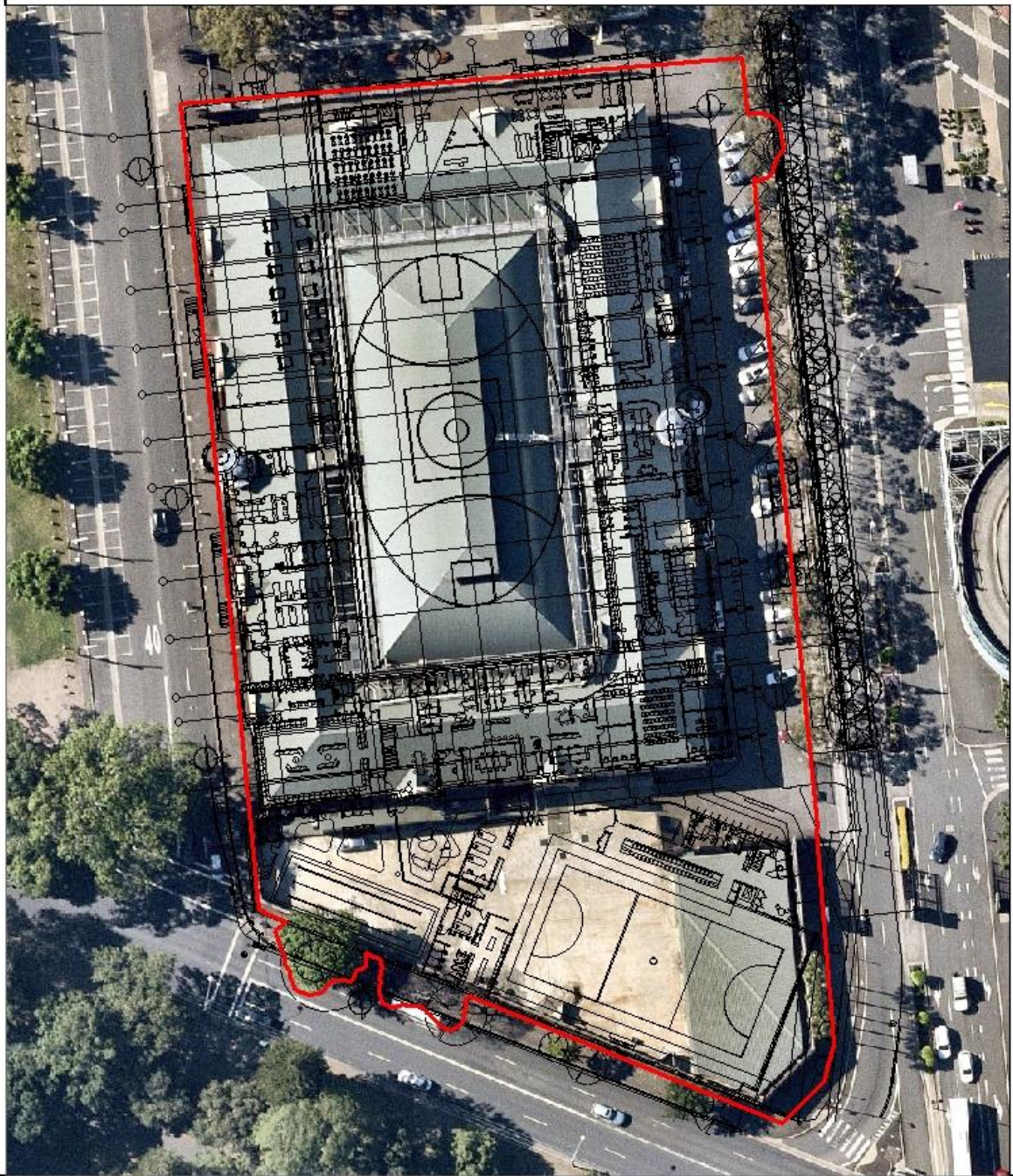


Figure 2: Location Map

Construction Footprint

Sydney Swans Head Quarters, Moore Park

335746



335746

6247952



Figure 3: Development site footprint

1.2 Legislative context

Table 1: Legislative context

Name		Relevance to the project
Commonwealth		
<i>Environment Protection and Conservation Act 1999</i> (EPBC Act)	<i>Protection Biodiversity Act 1999</i>	Matters of National Environmental Significance (MNES) have been identified on or near the development site. This report assesses impacts to MNES and concludes that the development is not likely to have a significant impact on MNES.
State		
<i>Environmental Planning and Assessment Act 1979</i> (EP&A Act)	<i>Planning Act 1979</i>	The proposed development is State Significant Development and requires consent under the EP&A Act.
<i>Biodiversity Conservation Act 2016</i> (BC Act)		<p>Section 7.9 of the BC Act requires the submission of the SSD to be accompanied by a Biodiversity Development Assessment Report (BDAR) (i.e. this report). Secretary's Environmental Assessment Requirements have been issued and require assessment of the following:</p> <p><i>10. Biodiversity: The EIS shall provide an assessment of the proposal's biodiversity impacts in accordance with the Biodiversity Conservation Act 2016, including the preparation of a Biodiversity Development Assessment Report where required under the Act.</i></p>
<i>Fisheries Management Act 1994</i> (FM Act)		The development does not involve impacts to Key Fish Habitat, does not involve harm to marine vegetation, dredging, reclamation or obstruction of fish passage. A permit or consultation under the FM Act is not required.
<i>Water Management Act 2000</i> (WM Act)		The project does not involve works on waterfront land. A Controlled Activity Approval under s91 of the WM Act is not required.
<i>Local Land Services Amendment Act 2016</i> (LLS Act)		The LLS Act does not apply to areas of the state to which the State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017 applies. This SEPP applies to the City of Sydney local government area, in which the proposed development site is located (see Vegetation SEPP below).
Planning Instruments		
State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017 (Vegetation SEPP)		The Vegetation SEPP applies to development that does not require consent. As this project requires consent under the EP&A Act the Vegetation SEPP is not applicable.
SEP (Coastal Management) 2018		The proposed development site is not located on land subject to SEPP (Coastal Management) 2018.
SEPP 44 - Koala Habitat Protection (SEPP 44)		The proposed development site is not located within a Local Government Area (LGA) to which SEPP 44 applies.
Sydney Local Environment Plan (LEP) 2012		The proposed development site is within the map boundaries of SEPP 47 – Moore Park Showground, and as such the local provisions of the Sydney LEP 2012 do not apply.
Sydney Development Control Plan (DCP) 2012		<p>The Sydney DCP has been reviewed for additional biodiversity provision which may relate to the development site. Section 3.5.1 Urban Ecology of the DCP relates to the:</p> <ul style="list-style-type: none"> Protection of existing habitat features within and adjacent to development sites

Name	Relevance to the project
	<ul style="list-style-type: none"> Improve the diversity and abundance of locally indigenous flora and fauna species across the LGA. <p>Under the DCP, development is to be consistent with the Street Tree Master Plan, Park Tree Management Plans and the Landscape Code. These matters have been addressed in this report.</p>
SEPP 47 – Moore Park Showground (SEPP 47)	<p>The proposed development site is within the map boundaries of SEPP 47. The proposed development site is largely shown as vertically hatched on the SEPP map. A small portion in the southeast corner of the proposed development site is mapped as diagonally hatched. As such, Part 2 and Part 3 of the SEPP apply. The SEPP aims to provide recreational facilities. The proposed development is consistent with the SEPP.</p>

1.3 Landscape features

1.3.1 Interim Biogeographic Regionalisation for Australia (IBRA) regions and subregions

The development site falls within the IBRA region and subregions as outlined in Table 2 and Table 3.

Table 2: IBRA regions

IBRA region	Area within development site (ha)
Sydney Basin	1.07

Table 3: IBRA subregions

IBRA subregion	Area within development site (ha)
Pittwater	1.07

1.3.2 Mitchell Landscapes

The development site falls within the Sydney – Newcastle Barriers and Beaches Mitchell Landscapes (DECC 2002) as outlined in Table 4.

Table 4: Mitchell Landscapes

Mitchell landscape	Description	Area within Development Site (ha)
Sydney – Newcastle Barriers and Beaches	Quaternary coastal sediments on long recurved quartz sand beaches between rocky headlands backed by sand dunes and intermittently closed and open lagoons. This includes areas of more extensive high dunes often located on top of the headlands. General elevation 0 to 30 m, local relief 10 m. Cliff top dunes may be found as high as 90 m above sea level. Distinct zonation of vegetation and increasing soil development from the beach to the inland dunes.	1.07

1.3.3 Native vegetation extent

The extent of native vegetation within the development site and buffer is outlined in Table 5. There are no differences between the mapped vegetation extent and the aerial imagery.

Table 5: Native vegetation extent

Area within the development site (ha)	Area within the 1,500 m buffer	Cover within the 1,500 m buffer area (%)
96.85 ha	771.42 ha	13%

1.3.4 Rivers and streams

The development site does not contain any rivers or streams.

1.3.5 Wetlands

The development site does not contain any wetlands.

1.3.6 Connectivity features

The development site contains limited connectivity features outlined in Table 6.

Connectivity to any vegetation has been disconnected by the formation of major arterial roads and urban multistorey development. Large *Ficus* sp. are established along roads and within open spaces such as Moore Park, Moore Park Golf Course and Centennial Park. Centennial park is located 500 m directly east of the development site and contains intact native vegetation. However, outside of the 1,500 m buffer the connectivity is limited to occasional roadside street trees. Therefore, some connectivity may remain for highly mobile species such as bird and bat species. This includes flyways between vegetation patches.

Table 6: Connectivity features

Connectivity feature name	Feature type
Centennial Park	Core bushland and riparian areas
Moore Park	Connectivity link

1.3.7 Areas of geological significance and soil hazard features

The development site does not contain areas of geological significance and soil hazard features.

1.3.8 Site context

1.3.8.1 Method applied

The site-based method has been applied to this development.

1.3.8.2 Percent native vegetation cover in the landscape

The current percent native vegetation cover in the landscape was assessed in a Geographic Information System (GIS) using aerial imagery sourced from Nearmap using increments of 5%. The results of this analysis are shown in Table 7.

Table 7: Percent native vegetation cover in the landscape

Area within the development site (ha)	Area within the 1,500 m buffer	Cover within the 1,500 m buffer area (%)
96.85 ha	771.42 ha	13%

1.3.8.3 Patch size

Patch size was calculated using available vegetation mapping for all patches of intact native vegetation on and adjoining the development site. The patch size area is 81 ha, this includes patches of Urban Exotic / Native vegetation as mapped by OEH (2013) vegetation mapping.

1.4 Native vegetation

1.4.1 Survey effort

The initial site inspection was undertaken on 4 March 2019 by accredited assessor Kirsten Velthuis (BAAS 19048) to identify potential biodiversity values of the development site.

Vegetation survey was undertaken within the development site by Belinda Failes on 24 October 2019 (Figure 5). A total of one full-floristic and vegetation integrity plot was undertaken to identify Plant Community Types (PCTs) and threatened ecological communities (TECs) within the development site (Table 8 and Table 9). A modified version of the vegetation integrity plot was undertaken to account for the narrow vegetation zone. The integrity plot was modified into a 10 m x 100 m configuration. The

site inspection also involved an assessment of habitat features including documenting hollow-bearing trees (HBTs), threatened species foraging resources and a general traverse of the vegetation immediately adjacent to the development site.

All field data collected at full-floristic and vegetation integrity plots is included in Appendix B:.

Table 8: Full-floristic PCT identification plots

PCT ID	PCT Name	Number of plots surveyed
1776	Smooth-barked Apple - Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast	1

Table 9: Vegetation Zones

Veg Zone	PCT ID	PCT Name	Condition	Total area (ha)	Plots required	Plots surveyed
1	1776	Smooth-barked Apple - Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast	Low	0.009	1	1
2	N/A	Exotic vegetation	Low	0.002	0	0

1.4.2 Plant Community Types present

The development site contained predominantly human-made structures (Photo 1) and limited vegetation. A row of planted native canopy species was located along the eastern boundary (Photo 2). A small raised garden contained several tall planted *Livistona australis* (Cabbage Palm) and *Syzygium* species located along the southern boundary. Several exotic street trees were recorded along Lang Road and will be trimmed during the proposed works (Photo 3). The remaining portion of the development site contains the RHI and concrete open space. Under BAM, planted vegetation native to NSW requires consideration as to the 'best-fit' PCT.

One PCT was identified within the development site (Table 10, Figure 4) and is not listed as a TEC under the BC or EPBC Acts. The development site does not contain any listed TECs under the BC Act or EPBC Act. Justification for the selection of PCTs occurring on the development site is provided in Table 11.

Table 10: Plant Community Types

PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Total area (ha)	Percent cleared
1776	Smooth-barked Apple - Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast	Sydney Coastal Dry Sclerophyll Forest	Dry Sclerophyll Forest (Shrubby sub-formation)	0.009	64%



Photo 1: Royal Hall of Industries looking east from Driver Avenue



Photo 2: Vegetation zone 1 - *PCT 1776 Smooth-barked Apple-Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast_planted*



Photo 3: Exotic vegetation along Lang Road to be trimmed during the removal of the wall. Note the Jacaranda tree in background contains a tree hollow

1.4.3 PCT selection justification

One PCT was recorded within the development site, PCT 1776 *Smooth-barked Apple - Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast*. The desktop database assessment and site inspection did not record remnant vegetation within the development site or within the broader locality of the development site. The absence of remnant vegetation makes the selection of an appropriate PCT problematic. Additionally, the BAM vegetation integrity data and floristic data could not be used to quantitatively determine the appropriate PCT as only one species was recorded within the plot, and this species is not characteristic of a species from a known local PCT.

A review of the available vegetation database mapping within the broader landscape of the development site recorded the presence of two mapped PCTs, (PCT 1828 and PCT 1231) however, these

PCTs did not represent the geographic location or aspect found within the development site (see Table 11). In the absence of suitable pre-European vegetation data, a description of the Mitchell Landscape and soil landscape was used as an indicator of the historical soil landscape and potential characteristic species represented within the development site. A description of the Mitchells Landscape is found in Table 4.

Tuggerah soil landscapes were mapped within the development site. This soil landscape is associated with coastal dunefields which contain dry sclerophyll forests (Chapman and Murphy 1989). In summary, the pre-European vegetation may have contained a canopy of *Angophora costata* (Sydney Red Gum), *Eucalyptus pilularis* (Blackbutt) and *Corymbia gummifera* (Red Bloodwood). These dominant species were compared with vegetation descriptions present on the BioNet Vegetation Classification System (VIS). Additionally, the VIS search was refined by using the IBRA subregion and Sydney LGA. Justifications of the PCT selection criteria are provided in Table 11.

Table 11: PCT selection justification

PCT ID	PCT Name	Selection criteria	Species relied upon for identification of vegetation type and relative abundance
1776	Smooth-barked Apple - Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast	IBRA subregion, LGA and dominant species <i>Angophora costata</i> , <i>Eucalyptus piperita</i> , <i>Eucalyptus pilularis</i> and <i>Corymbia gummifera</i> from Mitchells' Landscapes and soil landscapes (Tuggerah)	This PCT was chosen as the best representation of the pre-European vegetation type within the development site. This PCT occurs on upper slopes and dry gullies on sandstone soils. The description of the PCT in VIS represents similarities to the vegetation described in Mitchell's Landscapes and Tuggerah soil landscapes.
1646	Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	IBRA subregion, LGA and dominant species (<i>Eucalyptus pilularis</i> and <i>Corymbia gummifera</i>) from Mitchells' Landscapes	Components of this PCT are associated with River-flat Eucalypt Forest which is a TEC and occurs along riparian habitats. This PCT was not selected as the development site is not associated with any known watercourses or riparian habitats and the vegetation in the VIS does not correlate to vegetation described in the Mitchell's Landscapes.
1845	Smooth-barked Apple - Red Bloodwood - Blackbutt tall open forest on shale sandstone transition soils in eastern Sydney	IBRA subregion, LGA and dominant species from Mitchells' Landscapes	Although the dominant species associated with the Mitchell Landscapes and soil landscapes occurs within this PCT (i.e. <i>Eucalyptus pilularis</i> and <i>Corymbia gummifera</i>) this PCT is associated with clay-influenced soils with residual shale or lateritic capping which does not represent the Tuggerah sandy soils identified within the development site.
1828	Coachwood - Lilly Pilly - Water Gum gallery rainforest in sandstone gullies of the Sydney basin	This PCT has been mapped within 1 km of the development site from OEH	This PCT is associated with sheltered sandstone riparian zones. The development site does not contain

PCT ID	PCT Name	Selection criteria	Species relied upon for identification of vegetation type and relative abundance
		2013 vegetation mapping datasets.	riparian zones. Therefore, this PCT was not chosen.
1231	Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion	This PCT has been mapped within 1 km of the development site from OEH 2013 vegetation mapping datasets.	This PCT is associated with drainages and depressions on sandy alluviums. The development site is not located within drainage lines or depressions. Therefore, this PCT was not chosen.
664	Banksia heath on aeolian sands of eastern Sydney suburbs, Sydney Basin Bioregion	IBRA subregion, LGA and dominant species from soil landscape description (<i>Angophora costata</i> and <i>Banksia aemula</i>)	This PCT contains heath vegetation which does not represent the dry sclerophyll forests described from soil landscapes.

1.4.4 Vegetation integrity assessment

A vegetation integrity assessment using the Credit Calculator (BAMC) was undertaken and the results are outlined in Table 12. In the BAMC the impact area of 0.005 ha was automatically increased to 0.01 ha for the vegetation zone.

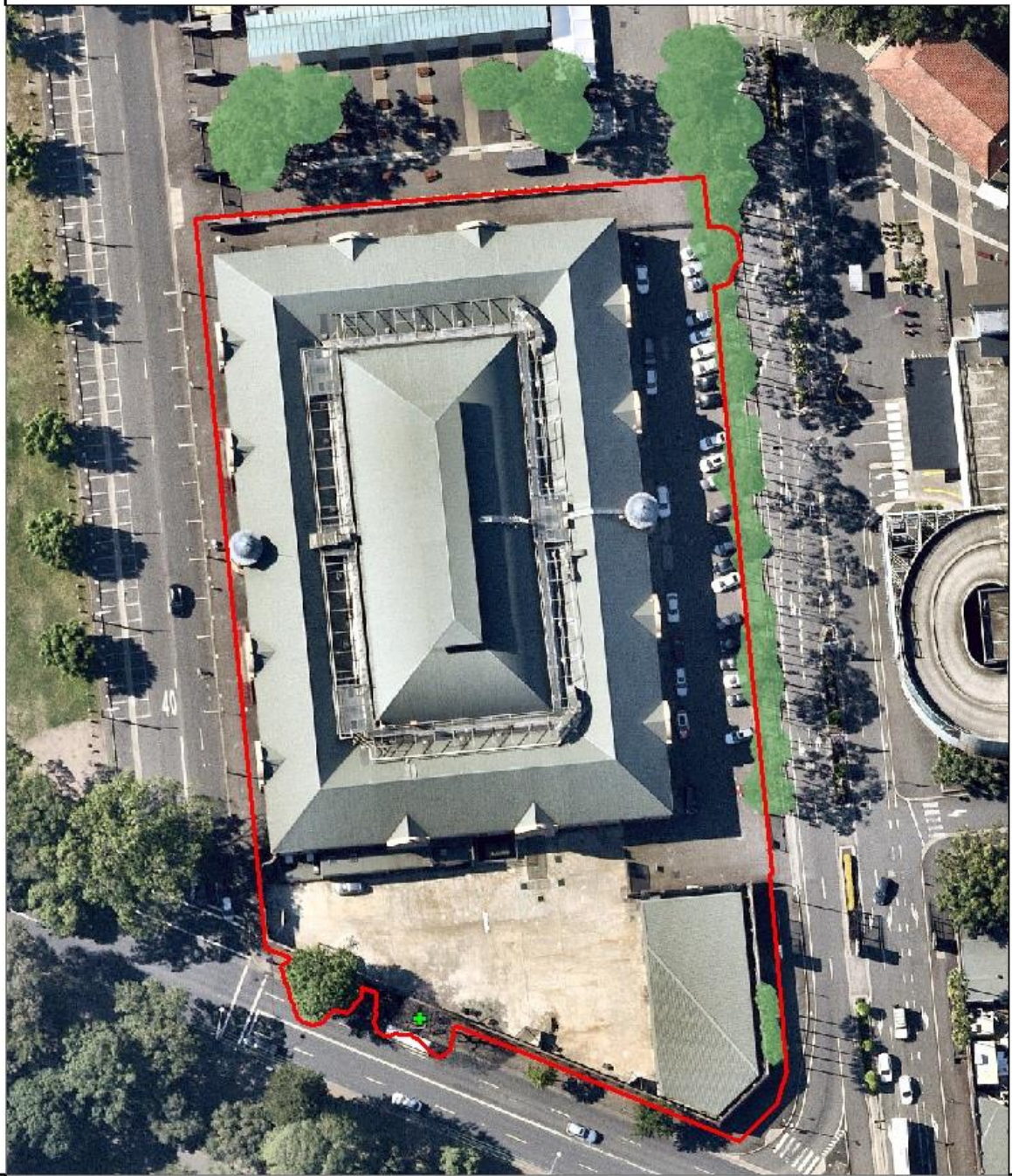
Table 12: Vegetation integrity

Veg Zone	PCT ID	Condition	Area (ha)	Composition Condition Score	Structure Condition Score	Function Condition Score	Current vegetation integrity score
1	1776	Smooth-barked Apple - Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast	0.005	0.5	7.8	13.8	3.7

Plant Community Types

Sydney Swans Head Quarters, Moore Park

335741



335741

6247954

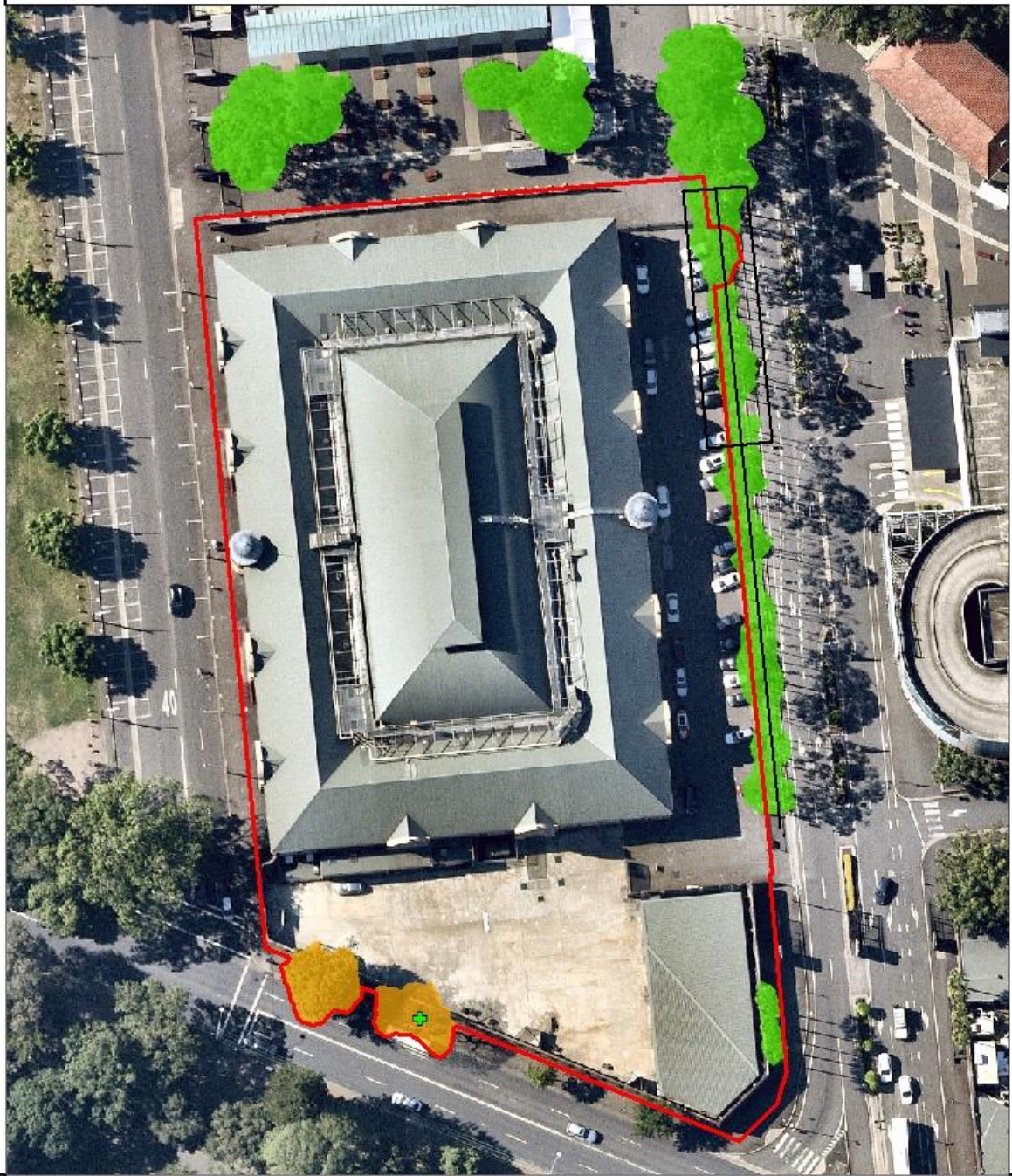


Figure 4: Plant Community Types and habitat features

Vegetation Zones and Survey Plots

Sydney Swans Head Quarters, Moore Park

335741



335741

6247954



Figure 5: Vegetation zones and plot location

1.5 Threatened species

Habitat assessments were undertaken as part of the field surveys. Habitat assessments involved a search of possible hollow-bearing trees (HBTs) within the development site and on ground inspection of roof cavities using binoculars for possible entrances for microbats, and inspection for other associated evidence of fauna roosting habitat.

One hollow-bearing tree was recorded along the southern boundary, within a *Jacaranda mimosifolia* (Jacaranda) along Lang Road (Photo 3). The hollow dimension was approximate 15 cm wide and may provide habitat for common arboreal mammal species. This tree will be pruned to allow installation of hoarding during construction, but pruning will not affect the hollow. No tree hollows were considered to be of a suitable size to accommodate microbat species. A number of hollow-bearing trees were noted during a wider traverse of the adjacent lands surrounding the development site.

Due to the presence of a large number of mature *Ficus* species within the surrounding land, a number of bird species which are not common within urban environments, were heard calling from vegetation adjacent to the development site. Flowering of canopy species recorded along the eastern boundary of the development site may provide additional foraging resources for these bird species. The development site is also located in close proximity (i.e. 500 m) to Centennial Park which contains native vegetation and supplementary habitat resources for birds and bat species.

Human made structures were recorded within the development site and may contain habitat for microbat species which are assessed as prescribed impacts (see Section 2.1.2). Targeted surveys for microbats were undertaken within the development site and more information is provided in 1.6.1.

1.5.1 Ecosystem credit species

Ecosystem credit species predicted to occur at the development site, their associated habitat constraints, geographic limitations and sensitivity to gain class is included in Table 13.

Ecosystem credit species which have been excluded from the assessment and relevant justification is also included in Table 13.

Table 13: Justification for exclusion of predicted ecosystem credit species

Species	Common Name	Habitat constraints/ Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
<i>Anthochaera phrygia</i>	Regent Honeyeater (Foraging)	N/A	High	CE	CE	<u>Excluded</u> <i>Corymbia maculata</i> (Spotted Gum), which is identified as a key tree species for the Regent Honeyeater, was identified within the development site. However, the vegetation within the development site is substantially degraded and not considered suitable foraging habitat for this species.
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	N/A	Moderate	V	Not Listed	<u>Excluded</u> Habitat features for this species are not present at this site. The vegetation within the development site is substantially degraded.
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo (Foraging)	N/A	Moderate	V	Not Listed	<u>Excluded</u> Habitat features for this species are not present at this site. The vegetation within the development site is substantially degraded.
<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo (Foraging)	N/A	High	V	Not Listed	<u>Excluded</u> This species has a very specific foraging habitat requirement (i.e. presence of <i>Allocasuarina</i> or <i>Casuarina</i> cones). The development site does not comprise key habitat resources required for foraging.
<i>Daphoenositta chrysoptera</i>	Varied Sittella	N/A	High	V	Not Listed	<u>Excluded</u> Habitat present does not contain suitable habitat features for this species. The vegetation within the development site is substantially degraded.
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	N/A	High	V	E	<u>Excluded</u> Habitat features for this species are not present at this site. This species requires habitat features such as maternal den sites, an abundance of food (birds and small mammals) and large areas of relatively intact vegetation to forage.

Species	Common Name	Habitat constraints/ Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
<i>Glossopsitta pusilla</i>	Little Lorikeet	N/A	High	V	Not Listed	<u>Excluded</u> Flowering species, which the Little Lorikeet may utilise for occasional foraging, were identified within the development site. However, the vegetation within the development site is substantially degraded and not considered suitable foraging habitat for this species.
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle (Foraging)	Waterbodies Within 1 km of rivers, lakes, large dams or creeks, wetlands and coastlines	High	V	Not Listed	<u>Included</u> Habitat features associated with this species are not present in the development site. However, the development site is located within 1 km of large open waterbodies present in Centennial Park and thus this species was included in the assessment.
<i>Hieraetus morphnoides</i>	Little Eagle (Foraging)	N/A	Moderate	V	Not Listed	<u>Excluded</u> Habitat present does not contain suitable habitat features for this species. The vegetation within the development site is substantially degraded.
<i>Lathamus discolor</i>	Swift Parrot (Foraging)	N/A	Moderate	E	CE	<u>Excluded</u> <i>Corymbia maculata</i> (Spotted Gum), which is identified as a favoured feed tree for the Swift Parrot, was identified within the development site. However, the vegetation within the development site is substantially degraded and not considered suitable foraging habitat for this species.
<i>Lophoictinia isura</i>	Square-tailed Kite (Foraging)	N/A	Moderate	V	Not Listed	<u>Excluded</u> Habitat features associated with this species are not present on the development site. This species requires dry woodlands and open forests with a particular preference for timbered watercourses.
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	N/A	Moderate	V	Not Listed	<u>Excluded</u> Habitat features associated with this species are not present in the development site. This species occupies forests or woodlands dominated by box and ironbark eucalypts (especially Mugga Ironbark), which the development site is not dominated by.

Species	Common Name	Habitat constraints/ Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	N/A	High	V	Not Listed	Included A visual survey of potential microbat roosts at the RHI identified five entry / exit points considered likely to provide access to potential microbat roosting habitat within the RHI (ELA 2019).
<i>Miniopterus australis</i>	Little Bent-winged Bat (Foraging)	N/A	High	V	Not Listed	Included A visual survey of potential microbat roosts at the RHI identified five entry / exit points considered likely to provide access to potential microbat roosting habitat within the RHI (ELA 2019).
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat (Foraging)	N/A	High	V	Not Listed	Included A visual survey of potential microbat roosts at the RHI identified five entry / exit points considered likely to provide access to potential microbat roosting habitat within the RHI. Ultrasonic survey identified this species as definitely present within the development site (ELA 2019).
<i>Neophema pulchella</i>	Turquoise Parrot	N/A	High	V	Not Listed	Excluded Habitat features associated with this species are not present in the development site.
<i>Ninox connivens</i>	Barking Owl (Foraging)	N/A	High	V	Not Listed	Excluded Habitat features associated with this species are not present in the development site.
<i>Ninox strenua</i>	Powerful Owl (Foraging)	N/A	High	V	Not Listed	Included Marginal foraging habitat was identified in this assessment. A breeding pair is known to occupy Centennial Park, which is located less than 1 km away from the development site.
<i>Pandion cristatus</i>	Eastern Osprey (Foraging)	N/A	Moderate	V	Not Listed	Excluded Habitat features associated with this species are not present in the development site. This species is a specialist feeder requiring large open waterbodies which are absent from the development site.

Species	Common Name	Habitat constraints/ Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
<i>Petroica boodang</i>	Scarlet Robin	N/A	Moderate	V	Not Listed	<u>Excluded</u> Habitat features associated with this species includes an abundance of logs and fallen timber, these features were not present in the development site.
<i>Phascolarctos cinereus</i>	Koala (Foraging)	N/A	High	V	V	<u>Excluded</u> <i>Corymbia maculata</i> (Spotted Gum) identified as Koala feed tree, were identified within the development site. However, there is no connectivity for this species with other vegetation patches.
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox (Foraging)	N/A	High	V	V	<u>Included</u> Seasonal foraging habitat was identified in this assessment. A Nationally Important Flying-fox Camp is located in Lachlan Swamp, Centennial Park 1.3 km away.
<i>Tyto novaehollandiae</i>	Masked Owl (Foraging)	N/A	High	V	Not Listed	<u>Excluded</u> Habitat features associated with this species are not present in the development site.
<i>Varanus rosenbergi</i>	Rosenberg's Goanna	N/A	High	V	Not Listed	<u>Excluded</u> Habitat features for this species are not present in the development site. Critical habitat components such as subterranean termite mounds are not present in the development site. This species does not utilise arboreal termite mounds.

CE = Critically Endangered; E = Endangered; E2 = Endangered Population; V = Vulnerable

1.6 Species credit species

Species credit species predicted to occur at the development site (i.e. candidate species), their associated habitat constraints, geographic limitations and sensitivity to gain class is included in Table 14.

Species credit species which have been excluded from the assessment and relevant justification is also included in Table 14.

1.6.1 Targeted surveys

No targeted surveys were conducted for species credit species and no species polygons were required. However, due to the presence of a disused historic building with a large amphitheatre roof space, targeted surveys were conducted for microbat species and assessed as part of prescribed biodiversity impacts.

Some microbat species are dual credit species with only breeding habitat considered for species credits. None of the candidate dual credit species are known to breed in human-made structures such as roof cavities. However, under Section 9.2.1 of BAM, the assessor must take into consideration Prescribed Biodiversity Impacts including any human-made structures, which may be roosting habitat of the following threatened microbat species:

- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Miniopterus australis* (Little Bentwing-bat)
- *Miniopterus norfolkensis* (Eastern Free-tailed Bat)
- *Miniopterus schreibersii oceanensis* (Large Bentwing-bat).

The methodology and results for the microbat surveys are detailed in the Prescribed Biodiversity Impact Assessment Section 2.1.2.

Table 14: Justification for exclusion of species credit species

Species	Common Name	Habitat constraints/ Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
<i>Ancistrachne maidenii</i>	Ancistrachne maidenii	N/A	High	V	Not Listed	<u>Excluded</u> The presence of this species was not identified. It was determined that the habitat features associated with this species are not present within the development site.
<i>Anthochaera phrygia</i>	Regent Honeyeater (Breeding)	Other As per mapped areas	High	CE	CE	<u>Excluded</u> This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site is not within an important breeding area for the species as identified in the National Recovery Plan for the Regent Honeyeater 2016.
<i>Caladenia tessellata</i>	Thick Lip Spider Orchid	N/A	Moderate	E	V	<u>Excluded</u> Habitat for this species was not considered suitable in the development site. The site is substantially degraded, and this species occurs in grassy sclerophyll woodlands which were not recorded within the development site.
<i>Callistemon linearifolius</i>	Netted Bottle Brush	N/A	Moderate	V	Not Listed	<u>Excluded</u> The presence of this species was not identified (conspicuous species). The development site does not form part of the 5-6 populations remaining in the Sydney area.
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo (Breeding)	Hollow bearing trees Eucalypt tree species with hollows greater than 9 cm diameter	High	V	Not Listed	<u>Excluded</u> This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site does not contain breeding habitat such as Eucalypt trees with hollows >9cm in diameter and shrubs that are suitable for the species to utilise the site.

Species	Common Name	Habitat constraints/ Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo (Breeding)	Hollow bearing trees Living or dead tree with hollows greater than 15 cm diameter and greater than 5 m above ground	High	V	Not Listed	<u>Excluded</u> This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site does not contain larger patches of intact vegetation or trees with large hollows that are suitable for the species to utilise the site.
<i>Cercartetus nanus</i>	Eastern Pygmy-possum		High	V	Not Listed	<u>Excluded</u> Habitat present is substantially degraded such that this species is unlikely to utilise the development site. There is no nesting habitat present or preferred foraging habitat such as <i>Banksia</i> sp. present.
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	Cliffs Within 2 km of rocky areas containing caves, overhangs, escarpment, outcrops, or crevices, or within 2 km of old mines or tunnels	Very High	V	V	<u>Excluded</u> The development site does not contain cliffs and is not within 2 km of rocky areas, old mines or tunnels.
<i>Darwinia peduncularis</i>	Darwinia peduncularis	Rocky areas Or within 50 m of rocky areas	High	V	Not Listed	<u>Excluded</u> Habitat features associated with this species (rocky areas) are not present in the development site or within 40 m of the development site.
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle (Breeding)	Other Living or dead mature trees within suitable vegetation within 1 km of rivers, lakes, large dams or creeks, wetlands and coastlines	High	V	Not Listed	<u>Excluded</u> This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site does not contain larger patches of intact vegetation or trees with large hollows that are suitable for the species to utilise the site.
<i>Hibbertia puberula</i>	Hibbertia puberula	N/A	High	E	Not Listed	<u>Excluded</u> Habitat features associated with this species (sandy soils) are not present in the development site.

Species	Common Name	Habitat constraints/ Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
<i>Hibbertia spanantha</i>	Julian's Hibbertia	N/A	High	CE	CE	<u>Excluded</u> The presence of this species was not identified, and it was determined that the habitat features associated with this species, such as forest or light clay soils, are not present within the development site.
<i>Hieraaetus morphnoides</i>	Little Eagle (Breeding)	Other Nest trees – live – (occasionally dead) large old trees within vegetation	Moderate	V	Not Listed	<u>Excluded</u> This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site does not contain suitable breeding habitat.
<i>Lathamus discolor</i>	Swift Parrot (Breeding)	Other As per mapped areas	Moderate	E	CE	<u>Excluded</u> This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The Swift Parrot is known to breed in Tasmania.
<i>Lophoictinia isura</i>	Square-tailed Kite (Breeding)	Other Nest trees	Moderate	V	Not Listed	<u>Excluded</u> This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site does not contain breeding habitat that is suitable for the species to utilise the site. No nests were observed during field surveys.
<i>Miniopterus australis</i>	Little Bent-winged Bat (Breeding)	Caves Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code 'IC – in cave' Observation type code 'E nest-roost' With numbers of individuals > 500	Very High	V	Not Listed	<u>Excluded</u> This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site does not contain breeding habitat such as caves that are suitable for the species to utilise the site.

Species	Common Name	Habitat constraints/ Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
Or from the scientific literature						
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat (Breeding)	Caves Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code 'IC – in cave' Observation type code 'E nest-roost' With numbers of individuals > 500	Very High	V	Not Listed	<u>Excluded</u> This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site does not contain breeding habitat such as caves, tunnels, mines or culverts.
<i>Mixophyes iteratus</i>	Giant Barred Frog	Other Land within 40 m of semi-permanent and permanent drainages	Moderate	E	E	<u>Excluded</u> This species requires specific habitat resources which are not represented within the development site.
<i>Myotis macropus</i>	Southern Myotis	Hollow bearing trees Within 200 m of riparian zone, other Bridges, caves or artificial structures within 200 m of riparian zone, waterbodies This includes rivers, creeks, billabongs, lagoons, dams and other waterbodies on or within 200 m of the site	High	V	Not Listed	<u>Excluded</u> This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site does not contain breeding habitat such as suitable hollow bearing trees within 200m of water.
<i>Ninox connivens</i>	Barking Owl (Breeding)	Hollow bearing trees Living or dead trees with hollows greater than 20 cm	High	V	Not Listed	<u>Excluded</u>

Species	Common Name	Habitat constraints/ Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
		diameter and greater than 4 m above the ground				This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site does not contain breeding habitat such as hollow bearing trees.
<i>Ninox strenua</i>	Powerful Owl (Breeding)	Hollow bearing trees Living or dead trees with hollows greater than 20 cm diameter	High	V	Not Listed	<u>Excluded</u> This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site does not contain suitable breeding habitat such as hollow bearing trees.
<i>Pandion cristatus</i>	Eastern Osprey (Breeding)	Other Presence of stick-nests in living and dead trees (> 15 m) or artificial structures within 100 m of a floodplain for nesting	Moderate	V	Not Listed	<u>Excluded</u> This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site does not contain suitable breeding habitat such as large waterbodies or large nests.
<i>Petaurus norfolcensis</i>	Squirrel Glider	N/A	High	V	Not Listed	<u>Excluded</u> Habitat present is substantially degraded such that this species is unlikely to utilise the development site. Habitat in the development site is isolated and disturbed with a higher likelihood of this species more suitable habitat within the locality. Additionally, this species has a strong preference for old growth forests which does not include the development site.
<i>Petaurus norfolcensis</i> - endangered population	Squirrel Glider on Barrenjoey Peninsula, north of Bushrangers Hill	Barrenjoey Peninsula	High	E2	Not Listed	<u>Excluded</u> The proposed development is located 36 km south of the Barrenjoey Peninsula.
<i>Phascolarctos cinereus</i>	Koala (Breeding)	Other Areas identified via survey as important habitat	High	V	V	<u>Excluded</u> This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. Habitat present is considered unsuitable and substantially degraded such that this species is highly unlikely to utilise the site for breeding.

Species	Common Name	Habitat constraints/ Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status	Justification if species excluded
<i>Phascolarctos cinereus</i> - endangered population	Koala in the Pittwater Local Government Area	Pittwater LGA	High	E2	Not Listed	<u>Excluded</u> The proposed development is not located within the Pittwater LGA.
<i>Pimelea curviflora</i> var. <i>curviflora</i>	Pimelea curviflora var. curviflora	N/A	High	V	V	<u>Excluded</u> The presence of this species was not identified (conspicuous species) and it was determined that the habitat is substantially degraded such that this species is unlikely to utilise the development site.
<i>Pseudophryne australis</i>	Red-crowned Toadlet	N/A	Moderate	V	Not Listed	<u>Excluded</u> The development site does not contain dense vegetation or debris beside ephemeral creeks and gutters, a feature of breeding habitat for this species.
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox (Breeding)	Other Breeding camps	High	V	V	<u>Excluded</u> This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site does not contain any breeding sites that are suitable for the species to utilise.
<i>Tyto novaehollandiae</i>	Masked Owl (Breeding)	Hollow bearing trees Living or dead trees with hollows greater than 20 cm diameter	High	V	Not Listed	<u>Excluded</u> This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site does not contain hollow bearing trees.

CE = Critically Endangered; E = Endangered; E2 = Endangered Population; V = Vulnerable

Potential Microbat Roost Entry/Exit Sydney Swans Head Quarters, Moore Park

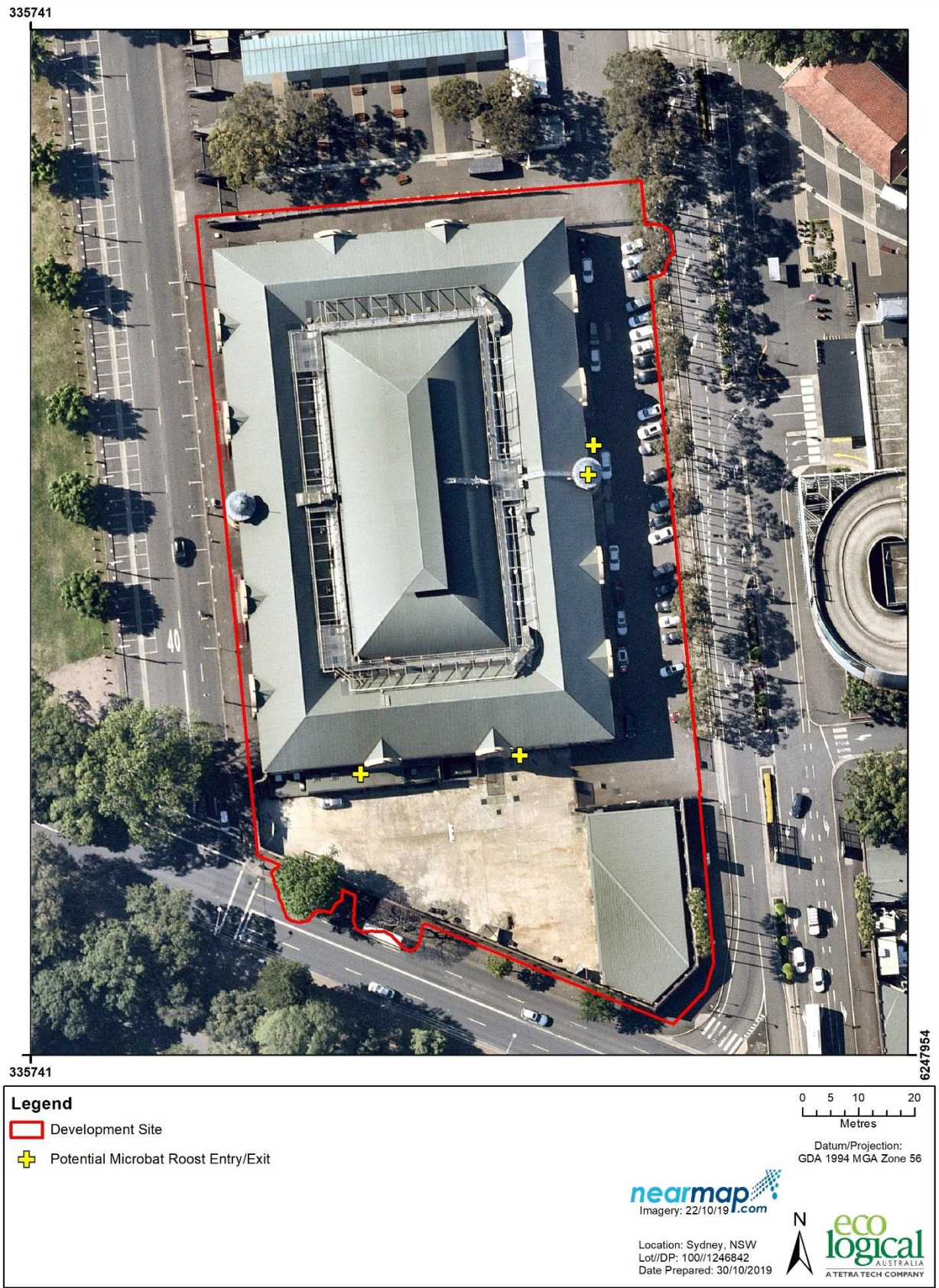


Figure 6: Potential microbat roost entry/ exits

2. Stage 2: Impact assessment (biodiversity values)

2.1 Avoiding impacts

2.1.1 Locating and designing a project to avoid and minimise impacts on vegetation and habitat

The project will result in the removal of a small patch of planted canopy species from the development site. The site is located in an urban area which avoids and minimises impacts to better quality vegetation and more important habitat in the locality, as outlined in Table 15. This development has also been designed in a way to avoid and minimise impacts. These matters have also been addressed in Table 15. As the development is located within an urbanised environment with low biodiversity values the locating and designing of a project assessment have been amalgamated.

Table 15: Locating and designing a project to avoid and minimise impacts on vegetation and habitat

Approach	How addressed	Justification
Locating and designing the project in areas where there are no biodiversity values	Biodiversity values within the proposed development site will be partially protected.	The development site does not contain significant biodiversity values such as TECs. However, the development site does contain a small area of planted native vegetation, a hollow bearing tree, and multiply entry / exit points for microbats into the RHI. Some planted native vegetation and the microbat access points will be removed as part of the project design. Some native and exotic planted canopy trees will be retained.
Locating and designing the project in areas where the native vegetation or threatened species habitat is in the poorest condition	The project has been designed and located within areas of disturbed planted vegetation and cleared or built land.	The project has been generally located to utilise existing disturbed or previously developed areas. The native vegetation within the development site has been planted. There are no indigenous threatened flora species recorded within the development site. There is no important habitat for threatened fauna species within the development site. Removal of some supplementary habitat will occur under the design. However, effort has been made to retain as many canopy species located along the eastern and southern boundary and only limited vegetation will be removed. Of the approximately 50 <i>Corymbia maculata</i> along the eastern boundary, only four are proposed to be removed and the remaining 46 will be retained. Additionally, pruning, rather than removing trees, have been adopted by the current design. Additionally, the construction footprint has been designed to retain the raised garden bed which contains the planted patch of <i>Livistona australis</i> .
Locating and designing the project in areas that avoid habitat for species and vegetation in high threat categories (e.g. an EEC or CEEC), indicated by the biodiversity risk weighting for a species	The project has been designed and located within areas of disturbed planted vegetation and cleared or built land.	The development site does not contain vegetation that comprises important habitat for threatened species or vegetation in high threat categories. Existing microbat access points to the RHI will be removed as part of the project design.
Locating and designing the project such that connectivity enabling movement of species and	The project is located in a highly fragmented landscape, some connectivity for highly	A number of native trees will be retained to provide connectivity for highly mobile species. The project design includes planting trees throughout the development site, contributing to connectivity for highly mobile species.

Approach	How addressed	Justification
genetic material between areas of adjacent or nearby habitat is maintained	mobile species will be retained in the landscape under the project design.	

2.1.2 Prescribed biodiversity impacts

The list of potential prescribed impacts as per the BAM is provided below:

- Occurrence of karst, caves, crevices and cliffs – none occur within the development site
- Occurrence of rock – no rock outcrops or scattered rocks occur within the development site
- Occurrence of human made structures and non-native vegetation – **Yes, see section below**
- Hydrological processes that sustain and interact with the rivers, streams and wetlands – none occur within the development site
- Proposed development for a wind farm and use by species as a flyway or mitigation route – the project does not involve a wind farm development.

The development site contains human made structures and non-native vegetation. Additional information regarding consideration of human made structures is provided below. Non-native vegetation will be trimmed as part of the works. The development site has the prescribed biodiversity impacts as outlined in Table 19.

A literature review was conducted to identify if buildings or structures could potentially be utilised as a roosting resource by microbats, including BioNet records within the development site and surrounding landscape.

The Microbat Survey Report (Appendix C) detailed the findings of microbat survey undertaken at the RHI in September 2019 and February 2020. Five potential microbat entries / exits to the RHI were identified and surveyed with ultrasonic call detection (anabats) and thermal imaging cameras.

Calls of up to four species of microbats were recorded with the call detection survey at the five potential bat entries / exits to the RHI. This included calls of one threatened species under the BC Act, *Miniopterus orianae oceanensis* (Large Bent-winged Bat) (Table 18). One likely microbat was identified on thermal infrared imaging camera emerging from one of the exits (near door 7), however no calls were recorded on the detector at that location at the time of the emergence, and the species of this likely bat could not be positively identified.

A rat was recorded at one of these potential microbat entries/ exits and was therefore not considered suitable for use by microbats; the remaining four potential microbat entries/ exits (figure 6) were still considered suitable as potential microbat entries/ exits based on the outcome of the surveys as detailed below.

The Large Bent-winged Bat call was recorded soon after dawn indicating that this species may roost close to or within the RHI. This species is known to use caves as primary roosting habitat but will also use derelict mines, storm-water tunnels, buildings and other human made structures (i.e. bridges) (OEH 2019). Breeding habitat is restricted to known maternity caves with specific humidity and temperature.

The RHI does not constitute breeding habitat for Large Bent-winged Bats. This is because this species is not known to breed in buildings and no evidence of large aggregations (1000s) of Large Bent-winged Bats (required to sustain a maternity roost) has been found at the RHI

Large Bent-winged Bats were not identified using the building as roosting habitat. However Large Bent-winged Bats were identified foraging close to the RHI and it is possible that individuals or small numbers of Large Bent-winged Bats use the RHI as roosting habitat, despite the survey not demonstrating this.

Table 16: Survey dates

Date	Survey	Target species
25 September 2019	Acoustic call detection survey	Microbat species
26 September 2019	Acoustic call detection survey	Microbat species
27 September 2019	Acoustic call detection survey	Microbat species
28 September 2019	Acoustic call detection survey	Microbat species
29 September 2019	Acoustic call detection survey	Microbat species
17 February 2020	Acoustic call detection and thermal imaging camera survey	Microbat species
18 February 2020	Acoustic call detection and thermal imaging camera survey	Microbat species
20 February 2020	Acoustic call detection and thermal imaging camera survey	Microbat species
21 February 2020	Acoustic call detection and thermal imaging camera survey	Microbat species

Table 17: Weather conditions

Date	Rainfall (mm)	Minimum temperature (C)	Maximum temperature (C)
25 September 2019	0	9.7	21.9
26 September 2019	0	12.6	20.8
27 September 2019	0	13.9	25.3
28 September 2019	0	15.3	21.7
29 September 2019	0	11.3	21.2
17 February 2020	1.2	20.8	25.3
18 February 2020	0.4	20.5	29.4
20 February 2020	0.2	18.2	25.6
21 February 2020	0	20.1	25.3

Table 18: Microbat species recorded during acoustic call detection surveys

Species	Common Name	Conservation status	Species presence	Geographic limitations
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	Vulnerable under BC Act	Recorded from acoustic call detection device	This species breeds in specific maternity caves. Outside breeding season, they may roost in mines, culverts or buildings.
<i>Austronomus australis</i>	White-striped Free-tailed Bat	N/A	Recorded from acoustic call detection device	This is a tree dwelling species

Species	Common Name	Conservation status	Species presence	Geographic limitations
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	N/A	Recorded from acoustic call detection device	This species may roost primarily in tree hollows but has been recorded in buildings
<i>Ozimops ridei</i>	Ride's Free-tailed Bat	N/A	Potentially Recorded from acoustic call detection device	This species may roost primarily in tree hollows but has been recorded in buildings

Table 19: Prescribed biodiversity impacts

Prescribed biodiversity impact	Description in relation to the development site	Threatened species or ecological communities effected
Impacts of development on the habitat of threatened species or ecological communities associated with: <ul style="list-style-type: none"> • karst, caves, crevices, cliffs and other geological features of significance, or • rocks, or • human made structures, or • non-native vegetation 	<p>The project will result in the replacement and recladding of the RHI roof, which will permanently remove four potential microbat entries/exits</p> <p>The proposed works will result in a reduction of 20% foliage canopy of one <i>Jacaranda mimosifolia</i> and 13% of one <i>Liquidambar styraciflua</i> located along Lang Road.</p>	<p>Potential non-breeding roosting habitat for</p> <ul style="list-style-type: none"> • <i>Falsistrellus tasmaniensis</i> (Eastern False Pipistrelle) • <i>Miniopterus australis</i> (Little Bentwing-bat) • <i>Miniopterus norfolkensis</i> (Eastern Free-tailed Bat) • <i>Miniopterus schreibersii oceanensis</i> (Eastern Bentwing-bat).
Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range	<p>The project will result in the replacement and recladding of the RHI roof, which will permanently remove four potential microbat entries/exits.</p> <p>The proposed works will result in a reduction of 20% foliage canopy of one <i>Jacaranda mimosifolia</i> and 13% of one <i>Liquidambar styraciflua</i> located along Lang Road. The development site is located within a matrix of large planted <i>Ficus</i> species which provide connectivity for highly mobile species between an urbanised landscape. The proposed works will result in the very minor reduction of the foliage canopy cover of two street trees These works will not result in the loss of connectivity between habitats within the landscape.</p>	<p>Potential non-breeding roosting habitat for</p> <ul style="list-style-type: none"> • <i>Falsistrellus tasmaniensis</i> (Eastern False Pipistrelle) • <i>Miniopterus australis</i> (Little Bentwing-bat) • <i>Miniopterus norfolkensis</i> (Eastern Free-tailed Bat) • <i>Miniopterus schreibersii oceanensis</i> (Eastern Bentwing-bat).
Impacts of development on movement of threatened species that maintains their lifecycle	<p>The project will result in the replacement and recladding of the RHI roof, which will permanently remove four potential microbat entries/exits, however the RHI is considered non-breeding roosting habitat only.</p>	None

Prescribed biodiversity impact	Description in relation to the development site	Threatened species or ecological communities effected
	The proposed works will result in a reduction of 20% foliage canopy of one <i>Jacaranda mimosifolia</i> and 13% of one <i>Liquidambar styraciflua</i> located along Lang Road. . Impacts to Grey-headed Flying Fox and Powerful Owl are likely to be marginal and not result in long term impacts to the local viable population.	

2.1.2.1 Locating and designing a project to avoid and minimise prescribed biodiversity impacts

The development has been located and designed in a way which avoids and minimises prescribed biodiversity impacts as outlined in Table 20.

Table 20: Locating and designing a project to avoid and minimise prescribed biodiversity impacts

Approach	How addressed	Justification
Locating and designing the development to avoid direct impacts on the habitat features	Only a small amount of only canopy of two non-native species, will be removed. The project will result in the replacement and recladding of the RHI roof, which will permanently remove the four potential microbat entries/exits; and which reduces availability of potential non-breeding roosting habitat for the threatened microbats	The development has avoided impacts to the majority of the planted canopy species located along the eastern perimeter of the development site. Vegetation will be trimmed and not removed along the southern boundary.
Locating and designing the project to avoid severing or interfering with corridors connecting different areas of habitat, migratory flight paths to important habitat or preferred local movement pathways	The project has reduced the amount of vegetation to be removed to reduce severing connectivity of vegetation within the landscape from seven trees to four trees.	Although the development will result in the removal of some native vegetation and trimming of some exotic vegetation within the development site, the connectivity will be retained through the adjacent vegetation along the eastern perimeter.
Optimising project layout to minimise interactions with threatened and protected species and ecological communities, e.g. designing turbine layout to allow buffers around features that attract and support aerial species, such as forest edges, riparian corridors and wetlands, ridgetops and gullies	The planning proposal has been located in an area which avoids impacts to areas of high biodiversity value in the locality.	The development site does not contain areas of high biodiversity values. The project layout has utilised the existing building footprint and open paved areas where possible for the development footprint. Some removal of native and exotic vegetation is required; however, this is limited to low biodiversity value vegetation.

2.2 Assessment of Impacts

2.2.1 Direct impacts

The direct impacts of the development on:

- native vegetation are outlined in Table 21
- threatened species and threatened species habitat is outlined in outlined in Section 2.2.4
- prescribed biodiversity impacts is outlined in Section 2.2.4.

Direct impacts including the final project footprint (construction and operation) are shown on Figure 7.

Table 21: Direct impacts to native vegetation

PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Direct impact (ha)
1776	Smooth-barked Apple - Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast	Sydney Coastal Dry Sclerophyll Forest	Dry Sclerophyll Forest (Shrubby sub-formation)	0.005

2.2.2 Change in vegetation integrity

The change in vegetation integrity as a result of the development is outlined in Table 22.

Table 22: Change in vegetation integrity

Veg Zone	PCT ID	Condition	Area (ha)	Current vegetation integrity score	Future vegetation integrity score	Change in vegetation integrity
	1776	Low	1.07	3.8	0	-3.8
	Smooth-barked Apple - Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast					

2.2.3 Indirect impacts

The indirect impacts of the development are outlined in Table 23.

Table 23: Indirect impacts

Indirect impact	Project phase	Nature	Extent	Frequency	Duration	Timing
Sedimentation and contaminated and/or nutrient rich run-off	Construction	Runoff during construction works	Confined to development site with	During heavy rainfall or storm events	During rainfall events	Short-term impacts

Indirect impact	Project phase	Nature	Extent	Frequency	Duration	Timing
			sediment fencing			
Noise, dust or light spill	Construction	Noise and dust created from machinery (no night works proposed therefore no light spill is anticipated)	Noise and dust likely to carry beyond development site boundary	Daily, during construction works	Sporadic throughout construction period	Short-term impacts
Inadvertent impacts on adjacent habitat or vegetation	Construction	Damage to adjacent habitat or vegetation	Adjacent vegetation	Daily, during construction works	Throughout construction period	Short-term impacts
Vehicle strike	Construction / operation	Potential for native fauna to be struck by working machinery and moving vehicles	Within access road and development site	Daily, during both construction and operational phases.	Throughout life of project	Short-term impacts
Rubbish dumping	Construction / operation	Illegal dumping by local residents/ construction crews	Potential for rubbish to spread via wind into adjacent site	Potential to occur at any time throughout construction or operational phases	Throughout life of project	Short-term impacts
Increase in pest animal populations	Construction / operation	Potential to increase if introduced	In vegetation in the southern portion of the development site	Potential to occur at any time throughout construction or operational phases	Throughout life of project	Short-term impacts

2.2.4 Prescribed biodiversity impacts

The development site has the prescribed biodiversity impacts as outlined in Table 24.

Table 24: Direct impacts on prescribed biodiversity impacts

Prescribed impact	biodiversity	Nature	Extent	Frequency	Duration	Timing
Impacts of development on the habitat of threatened species or ecological communities associated with:		Construction / operation / on-going	Confined to the development site. Modification of the roof and	Daily, during construction works Ongoing additional noise,	Throughout construction period and on-going	Long-term impacts

Prescribed impact	biodiversity	Nature	Extent	Frequency	Duration	Timing
<ul style="list-style-type: none"> karst, caves, crevices, cliffs and other geological features of significance, or rocks, or human made structures, or non-native vegetation 			internal structure of the RHI. Minor reduction of canopy of two non-native species.	vibration and light at night		
Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range		Construction / operation / on-going	Confined to the development site Production of noise, vibration and light	Daily, during construction works Ongoing additional noise and vibration during construction and additional light at night as part of the new development	Throughout construction period and on-going	Long-term impacts
Impacts of development on movement of threatened species that maintains their lifecycle		Construction / operation / on-going	Confined to the development site	Daily, during construction works Ongoing additional noise and vibration during construction and additional light at night as part of the new development	Throughout construction period and on-going	Long-term impacts

2.2.5 Mitigating and managing impacts

Measures proposed to mitigate and manage impacts at the development site before, during and after construction are outlined in Table 25.

Table 25: Measures proposed to mitigate and manage impacts

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
Displacement of resident fauna	High	Minor	Implementation of mitigation measures as detailed in the MMP: <ul style="list-style-type: none"> • Appointment of a project ecologist to ensure the MMP is implemented • Bat exclusion at suitable period (late March-May; or as a less ideal timeframe in September) prior to works commencing • Four microbat box installation in consultation with City of Sydney Urban Ecology Coordinator and Centennial Park and Moore Park Trust • Staff environmental inductions • Adaptive management techniques to allow flexibility if microbats are not found to be responding as expected to interventions and additional mitigation actions may be required 	Resident fauna relocated in a sensitive manner	Prior to and during clearing works and major roof modification	Project Manager / Ecologist
Timing works to avoid critical life cycle events such as breeding or nursing	High	Minor	Implementation of mitigation measures as detailed in the MMP. The exclusion of microbats from roosting habitat at the must occur during non-breeding or maternity seasons or overwinter hibernation and extended torpor seasons for microbats. Suitable time periods are late March to end of May; as a less ideal timeframe in September.	Impacts to fauna during nesting / nursing avoided	During clearing works and during peak noise or vibration production	Project Manager

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
Instigating clearing protocols including pre-clearing surveys, daily surveys and staged clearing, the presence of a trained ecological or licensed wildlife handler during clearing events	High	Minor	Ecologist or wildlife handler to supervise the pruning of the HBT (<i>Jacaranda mimosifolia</i>) to avoid impacts to potential roosting arboreal species. The exclusion of microbats from roosting habitat, to be undertaken prior to construction, using roost exclusion methodology described in the MMP.	Any fauna utilising habitat within the development site will be identified and managed to ensure clearing works minimise the likelihood of injuring resident fauna	During clearing works and during peak noise or vibration production	Project Manager / Ecologist
Installing artificial habitats for fauna in adjacent retained vegetation and habitat or human made structures to replace the habitat resources lost and encourage animals to move from the impacted site, e.g. nest boxes	High	Minor	Four bat nest boxes should be installed, as detailed in the MMP and in consultation with the City of Sydney Urban Ecology Coordinator, to provide microbat an alternative roost location prior to construction works within the development site.	Replacement of habitat features removed	Prior to and during clearing works	Project Manager / Ecologist
Clearing protocols that identify vegetation to be retained, prevent inadvertent damage and reduce soil disturbance; for example, removal of native vegetation by chain-saw, rather than heavy machinery, is preferable in situations where partial clearing is proposed	Minor	Negligible	Vegetation identified for retention along Erol Flynn Blvd and Lang Road should be delineated as a 'No Go' zone with high visibility bunting. No temporary facilities i.e. site offices/ toilets / soil stockpiles to occur within tree protection zone	Vegetation to be retained outside the development site boundary will not be disturbed / impacted	Demarcation of vegetation to be set up prior to any works occurring on site and to remain throughout the duration of construction works	Project Manager
Sediment barriers or sedimentation ponds to control the quality of water released from the site into the receiving environment	Moderate	Minor	Appropriate controls are to be utilised to manage exposed soil surfaces and stockpiles to prevent sediment discharge into culverts and stormwater.	Erosion and sedimentation will be controlled	For the duration of construction works	Project Manager

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
			Soil and erosion measures such as sediment fencing, clean water diversion must be in place prior the commencement of the construction work and must be regularly inspected and maintained throughout the development of the site.			
Noise barriers or daily/seasonal timing of construction and operational activities to reduce impacts of noise	High	Minor	Where relevant and practical, noise barriers to be implemented to reduce impacts to adjacent nesting fauna species.	Limit night works or provide noise barriers to protect behaviour of nocturnal or diurnal fauna species	During clearing works and on-going	Project Manager / Ecologist
Light shields or daily/seasonal timing of construction and operational activities to reduce impacts of light spill	High	Minor	Light pollution can be reduced by limiting the duration of spotlight illumination, reducing the brightness of lights where possible, installing shield fixtures to reduce light scattering and using narrow-spectrum light sources to reduce the wavelengths likely to interfere with animal behaviour. High priority areas where the implementation of measure to reduce light pollution should be considered adjacent to microbat boxes and near the HBT.	Lighting impacts on nocturnal and diurnal fauna are minimised	During clearing works and on-going	Project Manager / Landscape Designer / Ecologist
Staff training and site briefing to communicate environmental features to be protected and measures to be implemented	Minor	Negligible	Construction staff to be briefed prior to work commencing to be made aware of any sensitive biodiversity values present and environmental procedures such as: <ul style="list-style-type: none"> The MMP Site environmental procedures (vegetation clearance limits, microbat management protocols, protection of HBT) 	All staff entering the development site are fully aware of all the ecological values present within the	To occur for all staff entering/working at the development site. Site briefing should be updated based on phase of the work and when environmental	Project Manager

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
			<ul style="list-style-type: none"> What to do in case of environmental emergency (chemical spills, fire, injured fauna) 	development site and documentation of what to do in case of any environmental emergencies.	issues become apparent.	
Making provision for the ecological restoration, rehabilitation and/or ongoing maintenance of retained native vegetation habitat on or adjacent to the development site	Minor	Negligible	<p>Landscaping in the development site is to use appropriate local native species.</p> <p>An additional 26 new native trees will be planted within the development site as per Section 4 of the Revised Public Domain and Landscaping Plans.</p>	Areas within the development site will be landscaped using appropriate species	Following major construction works	Project Manager

2.2.6 Serious and Irreversible Impacts (SAIL)

The development does not have any Serious and Irreversible Impacts (SAIL).

2.3 Risk assessment

A risk assessment has been undertaken for any residual impacts likely to remain after the mitigation measures (Table 25) have been applied. Likelihood criteria, consequence criteria and the risk matrix are provided in Table 26, Table 27 and Table 28 respectively.

Table 26: Likelihood criteria

Likelihood criteria	Description
Almost certain (Common)	Will occur, or is of a continuous nature, or the likelihood is unknown. There is likely to be an event at least once a year or greater (up to ten times per year). It often occurs in similar environments. The event is expected to occur in most circumstances.
Likely (Has occurred in recent history)	There is likely to be an event on average every one to five years. Likely to have been a similar incident occurring in similar environments. The event will probably occur in most circumstances.
Possible (Could happen, has occurred in the past, but not common)	The event could occur. There is likely to be an event on average every five to twenty years.
Unlikely (Not likely or uncommon)	The event could occur but is not expected. A rare occurrence (once per one hundred years).
Remote (Rare or practically impossible)	The event may occur only in exceptional circumstances. Very rare occurrence (once per one thousand years). Unlikely that it has occurred elsewhere; and, if it has occurred, it is regarded as unique.

Table 27: Consequence criteria

Consequence category	Description
Critical (Severe, widespread long-term effect)	Destruction of sensitive environmental features. Severe impact on ecosystem. Impacts are irreversible and/or widespread. Regulatory and high-level government intervention/action. Community outrage expected. Prosecution likely.
Major (Wider spread, moderate to long term effect)	Long-term impact of regional significance on sensitive environmental features (e.g. wetlands). Likely to result in regulatory intervention/action. Environmental harm either temporary or permanent, requiring immediate attention. Community outrage possible. Prosecution possible.
Moderate (Localised, short-term to moderate effect)	Short term impact on sensitive environmental features. Triggers regulatory investigation. Significant changes that may be rehabilitated with difficulty. Repeated public concern.
Minor (Localised short-term effect)	Impact on fauna, flora and/or habitat but no negative effects on ecosystem. Easily rehabilitated. Requires immediate regulator notification.
Negligible	Negligible impact on fauna/flora, habitat, aquatic ecosystem or water resources. Impacts are local, temporary and reversible. Incident reporting according to routine protocols.

Consequence category	Description
(Minimal impact or no lasting effect)	

Table 28: Risk matrix

Consequence	Likelihood				
	Almost certain	Likely	Possible	Unlikely	Remote
Critical	Very High	Very High	High	High	Medium
Major	Very High	High	High	Medium	Medium
Moderate	High	Medium	Medium	Medium	Low
Minor	Medium	Medium	Low	Low	Very Low
Negligible	Medium	Low	Low	Very Low	Very Low

Table 29: Risk assessment

Potential impact	Project phase	Risk (pre-mitigation)	Risk (post mitigation)
Vegetation clearing	Construction / operation	Low	Very Low
Sedimentation and contaminated and/or nutrient rich run-off	Construction	Medium	Low
Noise, dust or light spill	Construction	High	Low
Inadvertent impacts on adjacent habitat or vegetation	Construction	High	Low
Transport of weeds and pathogens from the site to adjacent vegetation	Construction	Low	Very Low
Vehicle strike	Construction / operation	Low	Very Low
Rubbish dumping	Construction / operation	Low	Very Low
Increase in pest animal populations	Construction / operation	Low	Very Low
Increased risk of fire	Construction / operation	Low	Very Low

2.4 Adaptive management strategy

Impacts associated with the proposed development have been considered and addressed in Section 2.5. This section is required for those impacts that are infrequent, cumulative or difficult to predict.

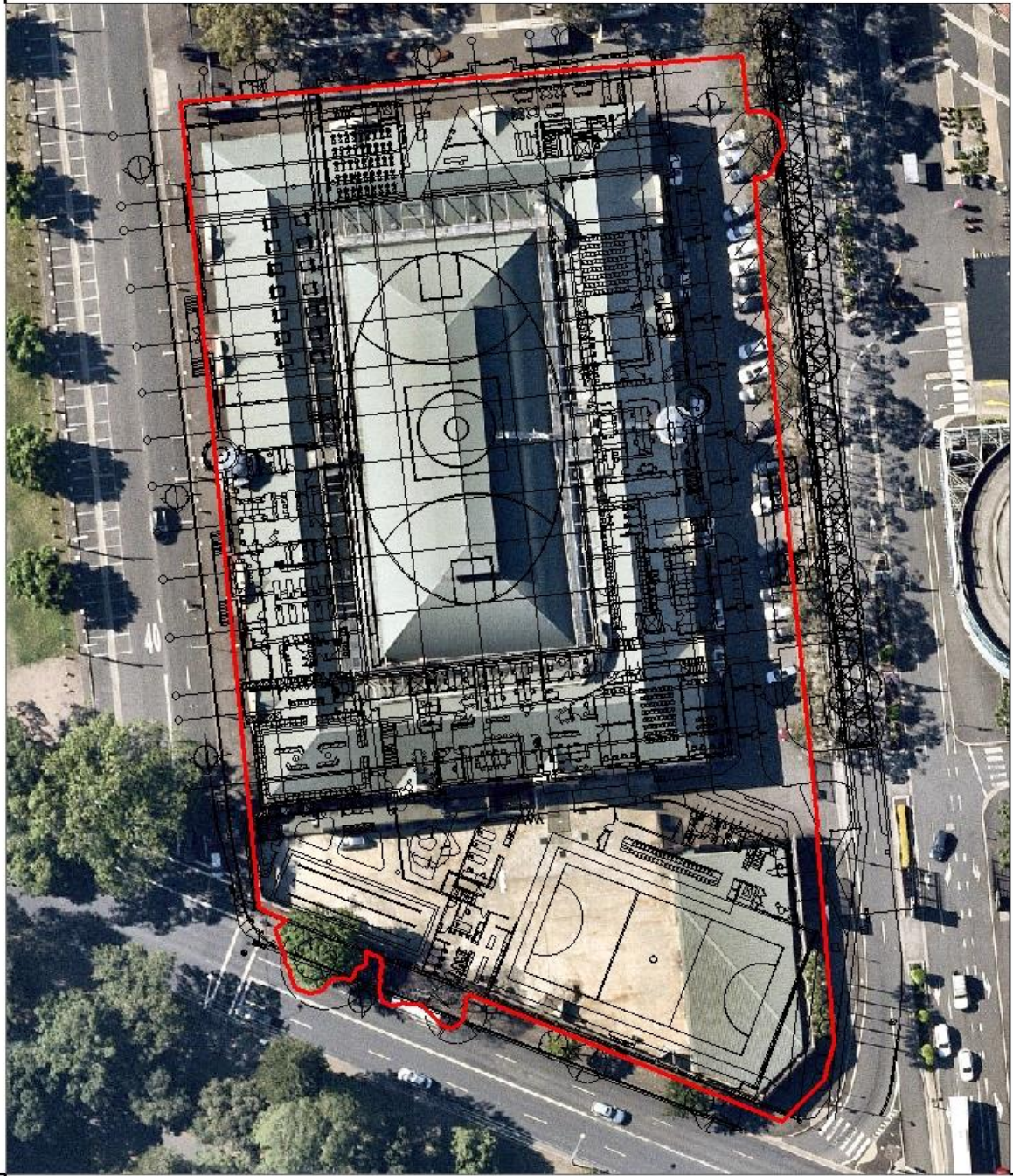
The MMP includes adaptive management techniques to be implemented if required. Wild animals can display unpredicted and unexpected behaviours, and the MMP is flexible in its application so that a range of potential outcomes can be dealt with in accordance with BC Act, NPWS scientific licencing and Animal Care and Ethics Committee approvals.

The aim is to facilitate the identification of the best course of action for the particular situation, including time and logistical constraints, as well as the biological constraints posed by the microbats. The procedures of the MMP may be adapted in response to factors such as in case where microbats do not emerg from the building to forage at the time of the exclusion process, which would have implications for the length of time it might take to exclude microbats from the RHI.

Construction Footprint

Sydney Swans Head Quarters, Moore Park

335746



6247952

335746



Figure 7: Final project footprint including construction and operation

2.5 Impact summary

Following implementation of the BAM and the BAMC, the following impacts have been determined.

2.5.1 Serious and Irreversible Impacts (SAIL)

The development does not have any Serious and Irreversible Impacts (SAIL).

2.5.2 Impacts requiring offsets

The development will not result in impacts requiring offsets. The vegetation integrity score for PCT 1776 was 3.8. This is lower than the threshold required for offsetting in accordance with Section 3.1.1.3 of the BAM.

2.5.3 Impacts not requiring offsets

The development will result in the direct removal of 0.005 ha of PCT 1776 vegetation. The vegetation integrity score for PCT was 3.8, which does not require offsetting are outlined in Table 30 and shown on Figure 8. The RHI (0.61 ha) provides roosting habitat for one threatened species, Large Bent-winged Bat. However, under the BAMC, only breeding habitat is considered for species credit species. This species has been assessed for prescribed impacts however, no offset credits are required.

Table 30: Impacts to vegetation not requiring offsets

PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Direct impact (ha)	Rationale
1776	Smooth-barked Apple - Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast	Sydney Coastal Dry Sclerophyll Forest	Dry Sclerophyll Forest (Shrubby sub-formation)	0.005	The vegetation integrity score of 3.8 was below the vegetation integrity score of 20 where the PCT is not representative of a TEC or associated with threatened species habitat, therefore, no offsets are required.

2.5.4 Areas not requiring assessment

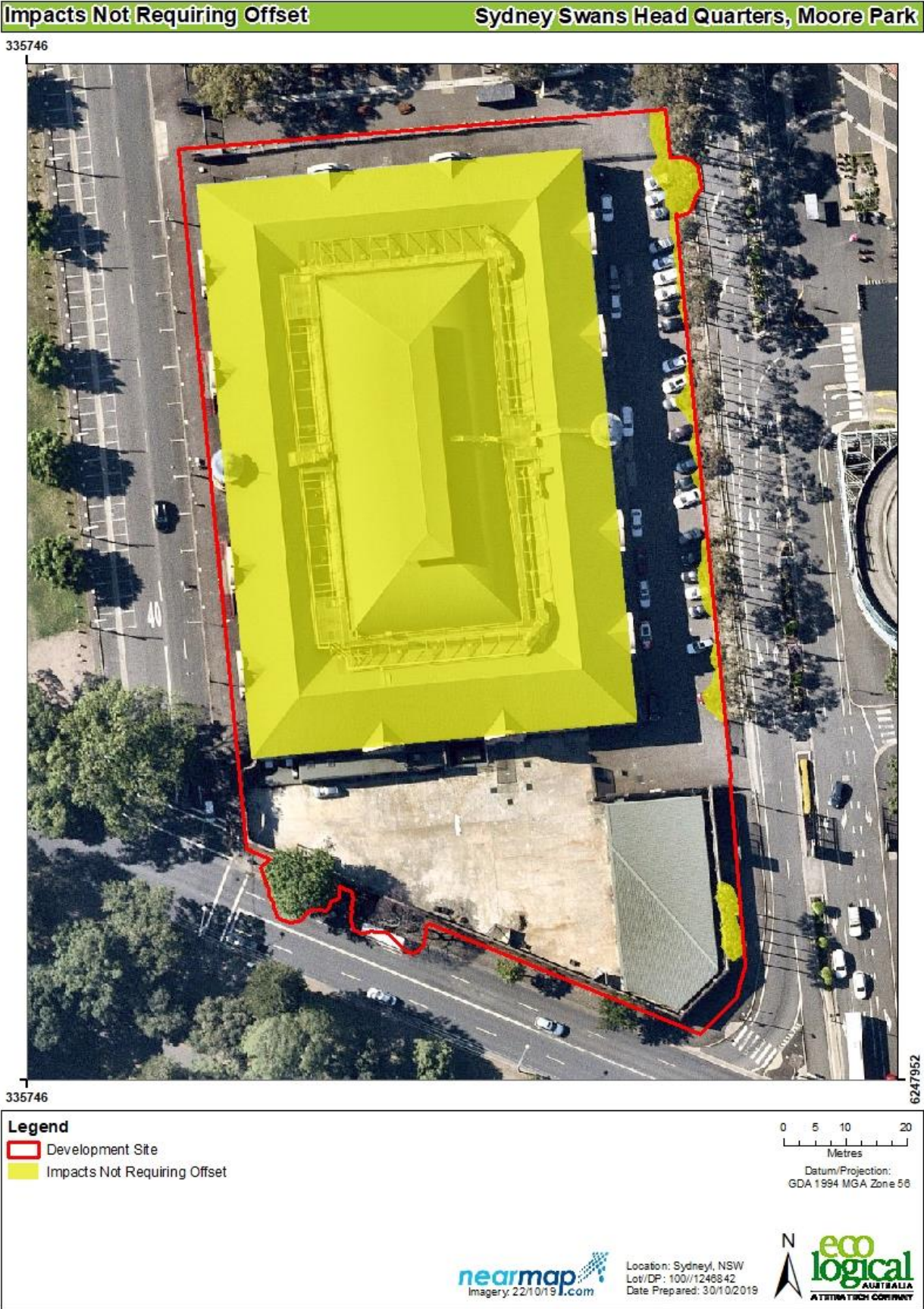
Areas not requiring assessment include existing concrete carpark and exotic vegetation. The development site contains cleared areas and exotic vegetation (0.007 ha) and are shown in Figure 9. These areas were not consistent with any listed PCT, nor did they contain any threatened species habitat for threatened species. Areas not requiring assessment are shown on Figure 9.

2.5.5 Credit summary

The number of ecosystem credits required for the development are outlined in Table 31. The number of species credits required for the development are outlined in Table 31. A biodiversity credit report is included in Appendix E:.

Table 31: Ecosystem credits required

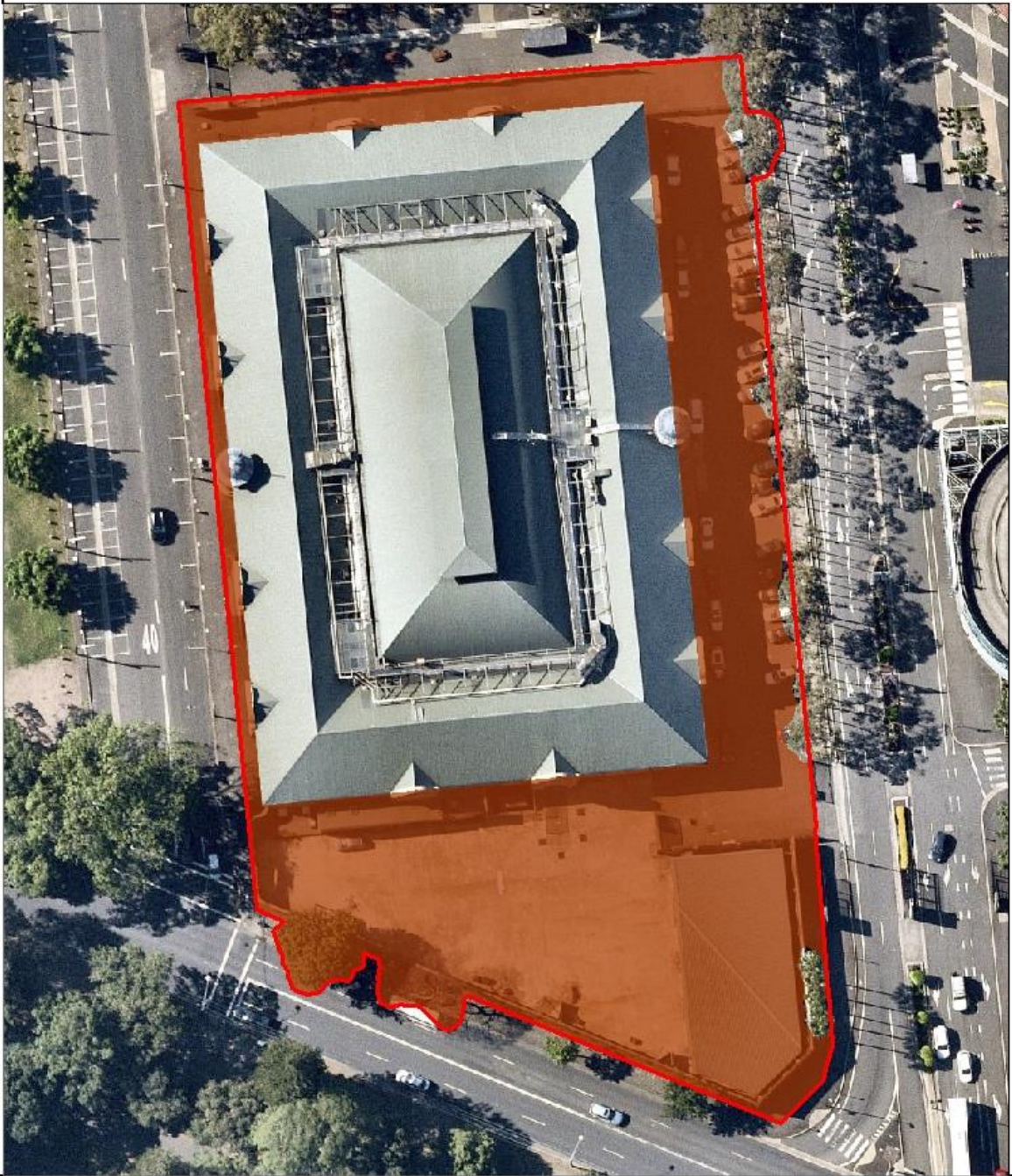
PCT ID	PCT Name	Vegetation Formation	Direct impact (ha)	Credits required
1776	Smooth-barked Apple - Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast	Dry Sclerophyll Forest (Shrubby sub- formation)	0.005	0



Areas Not Requiring Assessment

Sydney Swans Head Quarters, Moore Park

335746



6247952

335746



Figure 9: Areas not requiring assessment

2.6 Consistency with legislation and policy

Additional matters relating to impacts on flora and fauna which are not covered by the BC Act must also be addressed for the proposed development. Potential “Matters of National Environmental Significance” (MNES) in accordance with the EPBC Act have been addressed in Section 2.6.1. Matters relating to City of Sydney Council planning instruments have been addressed in Section 2.6.4.

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

The EPBC Act establishes a process for assessing the environmental impact of activities and developments where “Matters of National Environmental Significance” (MNES) may be affected. Under the Act, any action which “has, will have, or is likely to have a significant impact on a matter of MNES” is defined as a “controlled action”, and requires approval from the Minister or delegate of the Commonwealth Department of the Environment and Energy (DoEE), which is responsible for administering the EPBC Act (DoEE 2014).

The process includes conducting an Assessment of Significance for listed threatened species and ecological communities that represent a matter of MNES that will be impacted as a result of the proposed action. Significant impact guidelines (DoEE 2014) that outline a number of criteria have been developed by the Commonwealth, to provide assistance in conducting the Assessment of Significance and help decide whether or not a referral to the Commonwealth is required.

A habitat assessment and Likelihood of Occurrence was completed and one MNES *Pteropus poliocephalus* (Grey-headed Flying-fox) was assessed under the Act as there are BioNet records for this species within the broader landscape (5 km radius) of the development site.

The Grey-headed Flying-fox is listed as a Vulnerable species under the EPBC Act. This species utilises a wide variety of habitats (including disturbed areas) for foraging and have been recorded travelling long distances on feeding forays. Fruits and flowering plants of a wide variety of species are the main food source. The species roosts in large ‘camps’ of up to 200 000 individuals. Camps are usually formed close to water and along gullies, however, the species has been known to form camps in urban areas (DECCW 2009).

The Centennial Park Grey-headed Flying-fox (GHFF) camp is known from the locality to be within 1.3 km of the development site (OEH 2019c). The vegetation within the development site provides potential foraging habitat. It is considered likely that this species would use the site on occasion for foraging purposes. According to the National Flying-fox Monitoring Program, no GHFF camps currently occur or have been recorded within the development site (DoEE 2019).

Table 32: EPBC Act of Significance for *Pteropus poliocephalus* (Grey-headed Flying-fox)

Criterion	Assessment
Criterion a: lead to a long-term decrease in the size of an important population of a species	<p>The Matters of National Environmental Significance Impact Guidelines 1.1 (Commonwealth of Australia, 2013) defines an important population as a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:</p> <ul style="list-style-type: none"> • Key source populations either for breeding or dispersal • Populations that are necessary for maintaining genetic diversity, and/or • Populations that are near the limit of the species range

Criterion	Assessment
	No important populations have been recorded within the development site. The site does not support key source populations for breeding or dispersal, populations necessary for maintaining genetic diversity, or populations near the limit of the species range. According to the National Flying-fox Monitoring Program, no GHFF camps currently occur or have ever been recorded within the development site (DoEE 2019). The nearest active GHFF camp occurs approximately 1.3 km to the east of the development site, within Centennial Park (DoEE 2019).
Criterion b: reduce the area of occupancy of an important population	No important populations have been recorded within the development site. Therefore, the proposed works would not reduce the area of occupancy of an important population.
Criterion c: fragment an existing important population into two or more populations	No important populations have been recorded within the development site. The potential foraging habitat to be removed is marginal relative to adjacent potential habitat within the region. Whilst the potential foraging habitat may contribute as a 'stepping stone' for this highly mobile species to other more substantial foraging habitat sites, this function is unlikely to be significantly inhibited by the proposed works. Furthermore, this species has been recorded in urban environments and is likely to continue to forage adjacent to the development site and across the broader locality.
Criterion d: adversely affect habitat critical to the survival of a species	<p>Four of the 50 potential foraging canopy trees within the development site will be removed by the proposal. These individual trees represent a negligible amount of potential foraging resources in the locality. Additionally, planting of native canopy species has been recommended as part of the landscaping to compensate for the loss of four canopy species.</p> <p>Potential foraging habitat in the form of street trees will persist in close proximity to the development site. Given that this species is highly mobile (traveling up to 50 km to forage), it is considered unlikely that the works would adversely affect habitat critical to the survival of this species.</p>
e: disrupt the breeding cycle of an important population	According to the National Flying-fox Monitoring Program, no GHFF camps currently occur or have ever been recorded within the development site (DoEE 2019). The nearest active GHFF camp occurs approximately 1.3 km to the east of the development site within Centennial Park (DoEE 2019). Thus, no important population of GHFF occurs within the development site, and the proposed works are unlikely to disrupt the breeding cycle of an important population.
Criterion f: Adversely affect habitat critical to the survival of a species; modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	<p>The potential foraging habitat to be removed is limited to four immature Spotted Gums (<i>Corymbia maculata</i>). The Draft Recovery Plan for the Grey-headed Flying-Fox (DoEE, 2019) notes that this species is only considered to be a critical winter/ spring habitat resource south of Nowra NSW. Given the small amount of potential foraging habitat to be removed, that potential foraging habitat will persist adjacent to the development site and across the locality, and that this species is highly mobile, it is unlikely that the habitat to be removed would cause the species to decline. Furthermore, according to the National Flying-fox Monitoring Program, no GHFF camps currently occur or have ever been recorded within the development site (DoEE 2019). The nearest active GHFF camp occurs approximately 1.3 km to the east of the development site, within Centennial Park (DoEE 2019). Therefore, no known GHFF roosting camps for this species will be affected by the proposed works.</p> <p>The proposed works will not adversely affect habitat critical to the survival of GHFF.</p>
Criterion g: Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The proposed works will not result in the establishment of an invasive species that is harmful to GHFF.

Criterion	Assessment
Criterion h: Introduce disease that may cause the species to decline	The proposed works will not result in the introduction of a disease that is harmful to the GHFF.
Criterion i: Interfere substantially with the recovery of the species	Considering the above factors, the proposed works will not interfere substantially with the recovery of the species.
Conclusion	In consideration of the above, the proposed works are considered unlikely to have a significant impact on the GHFF.

2.6.2 Sydney Local Environmental Plan 2012 (LEP)

The development site is mapped under the Moore Park SEPP and therefore, the LEP does not apply.

2.6.3 State Environmental Planning Policy (SEPP) No 47 - Moore Park

The overall aims and objectives of this SEPP relevant to this proposal are as follows:

- *to enable the redevelopment of the Moore Park Showground in a manner that is consistent with its status as an area of importance for State and regional planning in New South Wales, and*
- *to improve and enhance the cultural and recreational facilities of Sydney for the people of New South Wales by furthering the development of Sydney as a world class film, television and video production centre, and*
- *to ensure that a range of impacts is considered by the consent authority in determining development applications, and*
- *to recognise the heritage significance of the Moore Park Showground and protect any archaeological relics.*

The development site is located within area mapped as the following:

- *Part 2 Development on land shown diagonally hatched and*
- *Part 3 Development on land shown vertically hatched*

The development design is considered appropriate according to the aims and objectives of the SEPP 47 Moore Park. The development design requires development consent for the proposed multi-purpose facility.

2.6.4 Sydney Development Control Plan 2012 (DCP)

Clause 3.5 Urban Ecology of the DCP objectives are as follows:

- *Protect existing habitat features within and adjacent to development sites*
- *Improve the diversity and abundance of locally indigenous flora and fauna species across the LGA.*

The provisions of the clause are as follows:

- *Development is to be consistent with the Street Tree Master Plan, Park Tree Management Plans and the Landscape Code.*

- *Existing habitat features including cliff lines, rocky outcrops, waterbodies, trees, shrubs and groundcover vegetation are to be retained.*
- *New habitat features including trees, shrubs and groundcover vegetation, waterbodies, rockeries and green roofs and walls are to be included, wherever possible.*
- *Link and enhance existing and potential biodiversity corridors wherever possible.*
- *Landscaping is to comprise a mix of locally indigenous tree, shrub and groundcover species as outlined in City's Landscape Code. Where this is not possible it is preferred that plants native to Australia are used.*
- *Shrubs are to be densely planted and trees are to be well-spaced, as outlined in the City's Landscape Code.*

The proposed development aims to conserve the majority of the native planted vegetation along the eastern perimeter of the development site and minimise unnecessary damage or removal of trees. Landscaping will be conducted in accordance with the above clause and include revegetation using locally indigenous native flora species (Arcadia Landscape Architecture, 2019b).

3. References

Allied Tree Consultancy 2019. Arborist addendum report – Royal Hall of Industries.

Arcadia Landscape Architecture 2019a. Sydney Swans HQ & Hordern Plaza Masterplan. Prepared for Sydney Swans Limited.

Arcadia Landscape Architecture 2019b. Sydney Swans and Community Centre Landscape Development Application. Prepared for Sydney Swans Limited.

Chapman, G.A. and Murphy, C.L. 1989. *Soil Landscapes of the Sydney 1:100 000 sheet*. Soil Conservation Service of NSW. Sydney.

Department of Environment and Climate Change. 2002, '*Descriptions for NSW (Mitchell) Landscapes Version 2*'. Accessed 8 May 2019 from:

<http://www.environment.nsw.gov.au/resources/conservation/landscapesdescriptions.pdf>

Department of Environment and Energy (DoEE) 2016. *Draft National Recovery Plan for the Grey-headed Flying-fox Pteropus poliocephalus*. DoEE, Sydney.

Department of Environment and Energy (DoEE) 2017. *Draft National Recovery Plan for the Regent Honeyeater*. DoEE, Sydney.

Department of the Environment and Energy (DoEE) 2019c. *National Flying-fox monitoring viewer*. Australian Government. Available: <http://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf>

Department of the Environment and Energy (DoEE) 2019d. Protected Matters Search Tool [online]. Available: <http://www.environment.gov.au/epbc/protect/index.html> (Accessed: May 2019).

Department of the Environment and Energy (DoEE) 2019e. Species Profile and Threats Database. Available <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>.

Eco Logical Australia (ELA) 1st November 2019. Sydney Swans Head Quarter Microbat Survey Report – Royal Hall of Industries.pdf. Prepared for APP on behalf of the Sydney Swans.

NSW Office of Environment and Heritage 2016. *The Native Vegetation of the Sydney Metropolitan Area. Volume 2: Vegetation Community Profiles*. Version 3.0. NSW Office of Environment and Heritage, Sydney.

NSW Environment, Energy and Science (EES) 2019a. Threatened Species Database (5 km radius search). EES Sydney, NSW.

NSW Environment, Energy and Science (EES) 2019b. Threatened Species Profiles. Available: <http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?>

Office of Environment and Heritage, 2019. Large Bent-winged Bat – profile. Online: <https://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10534> (Accessed 7 November 2019).

Urbis Pty Ltd 2019. Environmental Impact Statement: Sydney Swans High-performance Sport and Community Facility, Royal Hall of Industries. Prepared for Sydney Swans Limited.

Appendix A: Definitions

Terminology	Definition
Biodiversity credit report	The report produced by the Credit Calculator that sets out the number and class of biodiversity credits required to offset the remaining adverse impacts on biodiversity values at a development site, or on land to be biodiversity certified, or that sets out the number and class of biodiversity credits that are created at a biodiversity stewardship site.
BioNet Atlas	The BioNet Atlas (formerly known as the NSW Wildlife Atlas) is the EES database of flora and fauna records. The Atlas contains records of plants, mammals, birds, reptiles, amphibians, some fungi, some invertebrates (such as insects and snails) and some fish
Broad condition state:	Areas of the same PCT that are in relatively homogenous condition. Broad condition is used for stratifying areas of the same PCT into a vegetation zone for the purpose of determining the vegetation integrity score.
Connectivity	The measure of the degree to which an area(s) of native vegetation is linked with other areas of vegetation.
Credit Calculator	The computer program that provides decision support to assessors and proponents by applying the BAM, and which calculates the number and class of biodiversity credits required to offset the impacts of a development or created at a biodiversity stewardship site.
Development	Has the same meaning as development at section 4 of the EP&A Act, or an activity in Part 5 of the EP&A Act. It also includes development as defined in section 115T of the EP&A Act.
Development footprint	The area of land that is directly impacted on by a proposed development, including access roads, and areas used to store construction materials.
Development site	An area of land that is subject to a proposed development that is under the EP&A Act.
Ecosystem credits	A measurement of the value of EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur with a PCT. Ecosystem credits measure the loss in biodiversity values at a development site and the gain in biodiversity values at a biodiversity stewardship site.
High threat exotic plant cover	Plant cover composed of vascular plants not native to Australia that if not controlled will invade and outcompete native plant species.
Hollow bearing tree	A living or dead tree that has at least one hollow. A tree is considered to contain a hollow if: (a) the entrance can be seen; (b) the minimum entrance width is at least 5 cm; (c) the hollow appears to have depth (i.e. you cannot see solid wood beyond the entrance); (d) the hollow is at least 1 m above the ground. Trees must be examined from all angles.
Important wetland	A wetland that is listed in the Directory of Important Wetlands of Australia (DIWA) and SEPP 14 Coastal Wetlands
Linear shaped development	Development that is generally narrow in width and extends across the landscape for a distance greater than 3.5 kilometres in length
Local population	The population that occurs in the study area. In cases where multiple populations occur in the study area or a population occupies part of the study area, impacts on each subpopulation must be assessed separately.
Local wetland	Any wetland that is not identified as an important wetland (refer to definition of Important wetland).
Mitchell landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000.

Terminology	Definition
Multiple fragmentation impact development	Developments such as wind farms and coal seam gas extraction that require multiple extraction points (wells) or turbines and a network of associated development including roads, tracks, gathering systems/flow lines, transmission lines
Operational Manual	The Operational Manual published from time to time by EES, which is a guide to assist assessors when using the BAM
Patch size	An area of intact native vegetation that: a) occurs on the development site or biodiversity stewardship site, and b) includes native vegetation that has a gap of less than 100 m from the next area of native vegetation (or ≤ 30 m for non-woody ecosystems). Patch size may extend onto adjoining land that is not part of the development site or stewardship site.
Proponent	A person who intends to apply for consent to carry out development or for approval for an activity.
Reference sites	The relatively unmodified sites that are assessed to obtain local benchmark information when benchmarks in the Vegetation Benchmarks Database are too broad or otherwise incorrect for the PCT and/or local situation. Benchmarks can also be obtained from published sources.
Regeneration	The proportion of over-storey species characteristic of the PCT that are naturally regenerating and have a diameter at breast height < 5 cm within a vegetation zone.
Remaining impact	An impact on biodiversity values after all reasonable measures have been taken to avoid and minimise the impacts of development. Under the BAM, an offset requirement is calculated for the remaining impacts on biodiversity values.
Retirement of credits	The purchase and retirement of biodiversity credits from an already-established biobank site or a biodiversity stewardship site secured by a biodiversity stewardship agreement.
Riparian buffer	Riparian buffers applied to water bodies in accordance with the BAM
Sensitive biodiversity values land map	Development within an area identified on the map requires assessment using the BAM.
Site attributes	The matters assessed to determine vegetation integrity. They include: native plant species richness, native over-storey cover, native mid-storey cover, native ground cover (grasses), native ground cover (shrubs), native ground cover (other), exotic plant cover (as a percentage of total ground and mid-storey cover), number of trees with hollows, proportion of over-storey species occurring as regeneration, and total length of fallen logs.
Site-based development	a development other than a linear shaped development, or a multiple fragmentation impact development
Species credits	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection.
Subject land	Is land to which the BAM is applied in Stage 1 to assess the biodiversity values of the land. It includes land that may be a development site, clearing site, proposed for biodiversity certification or land that is proposed for a biodiversity stewardship agreement.
Threatened Biodiversity Data Collection	Part of the BioNet database, published by EES and accessible from the BioNet website.
Threatened species	Critically Endangered, Endangered or Vulnerable threatened species as defined by Schedule 1 of the BC Act, or any additional threatened species listed under Part 13 of the EPBC Act as Critically Endangered, Endangered or Vulnerable.

Terminology	Definition
Vegetation Benchmarks Database	A database of benchmarks for vegetation classes and some PCTs. The Vegetation Benchmarks Database is published by EES and is part of the BioNet Vegetation Classification.
Vegetation zone	A relatively homogenous area of native vegetation on a development site, land to be biodiversity certified or a biodiversity stewardship site that is the same PCT and broad condition state.
Wetland	An area of land that is wet by surface water or ground water, or both, for long enough periods that the plants and animals in it are adapted to, and depend on, moist conditions for at least part of their life cycle. Wetlands may exhibit wet and dry phases and may be wet permanently, cyclically or intermittently with fresh, brackish or saline water
Woody native vegetation	Native vegetation that contains an over-storey and/or mid-storey that predominantly consists of trees and/or shrubs

Appendix B: Vegetation plot data

Table 33: Vegetation integrity data (Composition, Structure and function)

Plot location data							
Plot no.	PCT	Vegetation Zone	Condition	Zone	Eastings	Northings	Bearing
1	1776	1	Planted	56	335902	6248076	154

Composition (number of species)						
Plot no.	Tree	Shrub	Grass	Forb	Fern	Other
1	1	0	0	0	0	0

Structure (Total cover %)						
Plot no.	Tree	Shrub	Grass	Forb	Fern	Other
1	15	0	0	0	0	0

Function											
Plot no.	Large Trees	Hollow trees	Litter Cover	Length Fallen Logs	Tree Stem 5-9	Tree Stem 10-19	Tree Stem 20-29	Tree Stem 30-49	Tree Stem 50-79	Tree Regen	High Threat Weed Cover
1	0	0	0	0	1	1	1	1	0	0	0

Table 34: Change in vegetation integrity scores for each management zone

Veg zone	Management zone	Area ha	Composition	Structure	Function	Vegetation integrity score	Change in score	Total Change in integrity score
1	Planted	0.005	0.5	7.8	13.8	3.7	-3.7	-3.7

Table 35: Species matrix (species recorded by plot)

Stratum	Form	Species name	Exotic (*)	High Threat Weed (*)	Cover (%) Plot 1
U	TG	<i>Corymbia maculata</i>			15

Table 36: Species matrix (species recorded during a traverse of the study area)

Family	Species name	Common Name	Native / Exotic
Altingiaceae	<i>Liquidambar styraciflua</i>	Liquidambar	E
Arecaceae	<i>Livistona australis</i>	Cabbage Fan Palm	N
Bignoniaceae	<i>Jacaranda mimosifolia</i>	Jacaranda	E
Caprifoliaceae	<i>Abelia x grandiflora</i>	Abelia	E
Malvaceae	<i>Brachychiton populneus</i>	Kurrajong	N
Myrtaceae	<i>Corymbia maculata</i>	Spotted Gum	N
Myrtaceae	<i>Angophora costata</i>	Sydney Red Gum	N
Myrtaceae	<i>Syzygium</i> sp.		N
Sapindaceae	<i>Cupaniopsis anacardioides</i>	Tuckeroo	N

Appendix C: Microbat Survey Report

A stylized topographic map with concentric contour lines in a light grey color, located on the left side of the page.

Sydney Swans Head Quarters Microbat Survey Report

Prepared for APP, on behalf of the Sydney Swans

DOCUMENT TRACKING

Project Name	Sydney Swans Head Quarter Microbat Survey Report
Project Number	19SUT12417
Project Manager	Kirsten Velthuis
Prepared by	Dee Ryder and Kirsten Velthuis
Reviewed by	Rodney Armistead, Alicia Scanlon
Approved by	Meredith Henderson
Status	Final
Version Number	v2
Last saved on	10 March 2020

This report should be cited as 'Eco Logical Australia 2020 *Sydney Swans Head Quarters Microbat Survey Report*. Prepared for APP on behalf of the Sydney Swans.'

Disclaimer

This document may only be used for the purpose for which it was commissioned and in accordance with the contract between Eco Logical Australia Pty Ltd and APP. The scope of services was defined in consultation with APP, by time and budgetary constraints imposed by the client, and the availability of reports and other data on the subject area. Changes to available information, legislation and schedules are made on an ongoing basis and readers should obtain up to date information. Eco Logical Australia Pty Ltd accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report and its supporting material by any third party. Information provided is not intended to be a substitute for site specific assessment or legal advice in relation to any matter. Unauthorised use of this report in any form is prohibited.

Template 2.8.1

Contents

1. Introduction	1
1.1 Project description.....	1
1.2 Location	1
2. Proposed development.....	1
3. Threatened microbat species roosting habitat potential	2
4. Survey Methods	3
4.1 Potential roost searches	3
4.2 Weather.....	3
4.3 Ultrasonic detection surveys	3
4.4 Emergence surveys.....	3
4.5 Thermal imaging surveys	4
4.6 Ultrasonic Call Analysis	4
5. Results	6
5.1 Potential roost searches	6
5.2 Weather.....	6
5.3 Ultrasonic detection survey.....	7
5.3.1 September 2019	7
5.3.2 Ultrasonic detection survey - February 2020.....	9
5.3.3 Ultrasonic call analysis limitations	10
5.4 Emergence surveys.....	11
5.5 Thermal imaging surveys	11
6. Interpretation of survey results	12
6.1.1 Presence of microbat roosting habitat	12
6.1.2 Significance of roosts	12
6.1.3 Presence of threatened microbat species	12
7. Conclusions and recommendations.....	14
Appendix A : Microbat survey location photos	15
Appendix B Examples of Call Profiles.....	17
Appendix C Infrared thermal camera images of likely bat emergence	19
8. References.....	21

List of Figures

Figure 1: Study area	1
----------------------------	---

List of Tables

Table 1: Correlations between current and previous nomenclature for the Free-tailed bats of NSW	5
Table 2: Survey temperatures and rainfall.....	6
Table 3: Microbat species and number of calls recorded at the RHI between 25 -29 September 2019...	8
Table 4: Microbat species and number of calls recorded at potential roostentry / exit 1, Door 7, 25 – 29 September 2019.....	9
Table 5: Microbat species and number of calls recorded at potential roost entry / exit 2, Door 8, 25 – 29 September 2019.....	9
Table 6: Microbat species and number of calls recorded at potential roost entry / exit point 3, outside the south- eastern wall, 25 – 29 September 2019.....	9
Table 7: Microbat species and number of calls recorded at potential roost entry / exit point 4, outside the eastern turret, 25 – 29 September 2019	9

1. Introduction

1.1 Project description

Eco Logical Australia Pty Ltd (ELA) was engaged by APP to undertake and report on a microbat survey at Moore Park in Sydney. This report will accompany a State Significant Development application for the proposed adaptive reuse of the Royal Hall of Industries (RHI) for a high-performance sport and community facility for the Sydney Swans.

1.2 Location

The subject site is located at 1 Driver Avenue, Moore Park (Lot 100 DP1246842).. The site consists of the RHI, and the associated courtyard area to the immediate south of the building.



Figure 1: Subject site: Royal Hall of Industries

2. Proposed development

The proposed development will largely maintain the structural integrity and façade of the RHI, while repurposing the interior of the building to support several compatible uses and utilise the space effectively. In addition to the repurposing of the RHI, an extension of the building will be constructed

to the south of the building in the current service and courtyard area and will include a pool and a netball court.

Actions required to complete these works include:

- replacing existing roof sheeting, gutters, fascia
- demolition and removal of all redundant mechanical equipment
- installing scaffolding around the perimeter of RHI
- investigating / measure skylights
- modifying roof structure for skylights/installation of aluminium sections
- installing skylights
- reglazing external windows and restore RHI façade.

Additionally, there is a mix of native and non-native landscaping vegetation within the study area, however there are no hollows suitable for microbats in any vegetation within the study area; and as such the proposal will not impact on any roosting habitat for bats in vegetation.

The purpose of this report is to outline the methodology employed during targeted surveys undertaken to determine:

- whether microbats are using the cavities within the RHI as roosting habitat
- the species and number of microbats that are using the cavities within the RHI as roosting habitat
- the status of the roosting habitat (breeding / winter / hibernation).

3. Threatened microbat species roosting habitat potential

The following data sources were reviewed to identify microbat species with the likelihood of using the RHI as potential roosting habitat:

- BioNet / Atlas of NSW Wildlife 5 km database search (DoPIE 2019)
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool 5 km database search (DotEE 2019)
- Threatened Biodiversity Data Collection (DoPIE 2019) Memorandum: Microbats in the Centennial Parklands (Anara Glynn, 12 Feb 2020)

The result of the data review identified the following threatened microbat species as having a likelihood of using the RHI as potential roosting habitat:

- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Miniopterus australis* (Little Bentwing-bat)
- *Miniopterus norfolkensis* (Eastern Free-tailed Bat)
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat).

4. Survey Methods

4.1 Potential roost searches

A diurnal visual survey of potential microbat roosts at the RHI was undertaken by ELA ecologist Kirsten Velthuis for a period of 3 hours on 1 September. This survey was repeated on 18 February by ELA microbat specialist Alicia Scanlon and Kirsten Velthuis for a period of 1 person hour.

Roost searches were conducted at ground level from both the internal ground floor space of the RHI and around the full perimeter of the RHI externally. In addition, the internal surfaces of the eastern and western turrets were viewed from the landing on the first floor, accessed via internal stairs. There was no view able to be obtained of the roof cavity or wall cavities; however it is understood that there are no wall or roof cavities, with the roof filled with metal sheeting with insulation and plasterboard. Photos of potential microbat entry/exit points were taken.

4.2 Weather

Surveys occurred during suitable weather conditions for recording microbat activity; mild temperatures, calm conditions and limited rainfall. Surveys were undertaken within (or just prior to) the optimum survey period for many threatened microbat species (October to February inclusive). Weather conditions experienced during surveys are recorded in Section 4.2.

4.3 Ultrasonic detection surveys

The visual survey was followed by ultrasonic call detection surveys of the five identified potential exit / entrance sites. A detector was placed at each potential roost entry / exit point for five consecutive nights between 25 and 29 September 2019; and for two nights at each potential roost between 17- and 21 February 2020. Total ultrasonic survey effort for September 2019 and February 2020 combined was 25 nights and 10 partial nights (seven nights / partial nights per entry / exit point).

The ultrasonic detection survey involved placing detectors at a suitable location on the ground or at elevated locations (up to 1 m above the ground) facing the potential roost entrances / exits. Detector placements were all within 8 m of the base of the building. Unattended detection began 30 minutes before sunset and continued until 3 hours after sunrise on each of the five nights between 25 and 29 September. Call detection in February 2020 began 30 minutes before sunset and continued until 1.5 hours after sunset.

4.4 Emergence surveys

Observation of each potential roost entry / exit point was undertaken over one night by an ecologist from 30 minutes before sunset until 1.5 hours after sunset during the September 2019 and February 2020 surveys. The ecologist was positioned on the ground outside the RHI within 8 m of the base of the building. There were no artificial light sources used during the emergence survey. In addition, an emergence survey of the eastern turret was undertaken from within the RHI on the first floor landing of the eastern turret during both the September 2019 and February 2020 surveys.

4.5 Thermal imaging surveys

In addition to diurnal roost searches, ultrasonic surveys and emergence surveys, thermal imaging cameras were used as a survey aid to enhance visual observations at each of the potential roost entry / exit points during the February surveys. Thermal imaging was undertaken for two nights at each potential roost entry / exit point from 30 minutes prior to sunset until 1.5 hours after sunset. Cameras used were FLIR E75 24° advanced thermal cameras. Each camera was hand-held by the ecologist for the duration of the emergence survey and the potential roost entry / exit point was viewed through the thermal camera screen set to display temperature in a rainbow colour palette. If a microbat was observed exiting or entering a potential roost, the ecologist triggered recording of images to the internal SD card.. The specifications of the FLIR E75 camera that are relevant for conducting surveys of microbat activity are:

- Frame rate of 30Hz which is the minimum required to detect an object the size and speed of a moving microbat
- Temperature range of -15°C to 50°C which encompasses the weather conditions experienced during thermal imaging surveys
- Thermal resolution of 320 x 240 pixels which is the minimum required for detecting objects the size of a microbat
- Field of view of 24° which was large enough to encompass the potential roost entry / exit point and a radius of approximately 4 m surrounding the entry / exit point, and would allow detection of a stationary bat up to 10 m away and a moving bat up to 60 m away
- Thermal sensitivity of <40 mK, with values between 20 and 50 mK suitable for bat surveys.

Thermal camera surveys were undertaken following the guidelines for use of thermal cameras as a survey aid provided in *Thermal Imaging: Bat Survey Guidelines* (Fawcett Williams and the Bat Conservation Trust 2019). ELA microbat specialist Alicia Scanlon directed the thermal camera surveys and has completed the Thermal Imaging for Wildlife (KFW Scientific) online course.

4.6 Ultrasonic Call Analysis

Bat calls were analysed by ELA specialist microbat ecologist and experienced call analyst Alicia Scanlon, and by ELA ecologist Rachel Brown, with supervision by Alicia Scanlon using the program AnalookW (Version 4.2n 16 March 2017, written by Chris Corben, www.hoarybat.com). Alicia has over twelve years of experience in the identification of ultrasonic call recordings. Call identifications are made using regional based guides to the echolocation calls of microbats in New South Wales (Pennay et al 2004); and south-east Queensland and north-east New South Wales (Reinhold et al 2001) and the accompanying reference library of over 200 calls from Sydney Basin, NSW (which is available at <http://www.forest.nsw.gov.au/research/bats/default.asp>).

A sample of the calls were reviewed by ELA ecologist Dr Rod Armistead who has over five years of experience in the identification of ultrasonic call recordings. External review of a sample of calls was also undertaken by Greg Ford of Balance Environmental, who has over 20 years of experience in this field.

Bat calls are analysed using species-specific call profile parameters including call shape, characteristic frequency, initial slope and time between pulses (Reinhold et al. 2001). To ensure reliable and accurate results the following protocols (adapted from Lloyd et al 2006) are followed:

- Search phase calls are used in the analysis, rather than cruise phase calls or feeding buzzes (McKenzie et al 2002). Cruise phase or feeding calls are labelled as being unidentifiable.
- Recorded calls containing less than three pulses are not analysed and these sequences are labelled as unidentifiable, being too short to confidently determine the identity of the species making the call (Law et al 1999)
- For those calls that are useful to identify the species making the call, two categories of confidence are used (Mills et al 1996):
 - Definitely present – the quality and structure of the call profile is such that the identity of the bat species making the calls is not in doubt
 - Potentially present – the quality and structure of the call profile is such that there is some / low probability of confusion with species that produce similar calls profiles
- Calls made by bats which cannot be used for identification purposes such as social calls, short and low-quality calls, cruise and approach phase calls are labelled as unidentifiable.
- Sequences labelled as unidentifiable are of inferior quality and therefore not able to be identified to any microbat species, they can however be used as an indicator of microbat activity at the site.
- *Nyctophilus* spp. (Long-eared bats) are difficult to identify confidently from their calls and no attempt is made to identify this genus to species level (Pennay et al 2004)
- The Free-tailed Bats (previously referred to as the genus *Mormopterus*) have recently undergone taxonomic revision (Reardon et al 2014) and published reference calls for this group of species (Pennay et al 2004) are believed to contain errors (Greg Ford pers comm.). This report uses nomenclature for Free-tailed bat species as referred to in Jackson and Groves (2015). The correlation between nomenclature used in this report and that used in NSW State legislation is presented in Table 1 below.
- Sequences not attributed to microbat echolocation calls (e.g. insect buzzes, wind, train and vehicle movement) were dismissed from the analysis.

Table 1: Correlations between current and previous nomenclature for the Free-tailed bats of NSW

Current Name (Jackson and Groves 2015)	Previous Name	Common Name	Biodiversity Conservation Act 2016 status
<i>Austronomus australis</i>	<i>Tadarida australis</i>	White-striped Free-tailed Bat	
<i>Micronomus norfolkensis</i>	<i>Mormopterus norfolkensis</i>	Eastern Coastal Free-tailed Bat	Vulnerable
<i>Ozimops petersi</i>	<i>Mormopterus</i> species 3 (small penis)	Inland Free-tailed Bat	
<i>Ozimops planiceps</i>	<i>Mormopterus</i> species 4 (long penis eastern form)	Southern Free-tailed Bat	
<i>Ozimops ridei</i>	<i>Mormopterus</i> species 2	Ride's Free-tailed Bat	
<i>Setirostris eleryi</i>	<i>Mormopterus</i> species 6	Bristle-faced Free-tailed Bat	Endangered

5. Results

5.1 Potential roost searches

The potential roost searches identified five entry / exit points considered likely to provide access to potential microbat roosting habitat within the RHI:

1. Outside the western side of Door 7 - cavities around the gutter pipe going into the building façade with some faint vertical yellow staining on the wood panel below the pipe.
2. Outside the eastern side of Door 8 - cavities around the gutter pipe going into the building façade with some faint vertical black/brown staining on the bricks below the pipe.
3. Outside the south-eastern wall of the RHI - cavities around the gutter pipe that lead into the building façade and holes in the wood panelling at the top of the façade.
4. Outside the eastern turret of the RHI - cavities that lead into the turret and a long cavity located in a wood panel along the top of the building façade.
5. Inside the eastern turret - several cavities in the internal brick wall, as well as cavities within the wooden floor separating the turret from the 1st floor. The turret in general also showed evidence of use by pigeons, as well as other animals (e.g. scats (of various sizes) evident); though none were identified in those cavities in the wall or floor which could be inspected

All potential entry / exit points are located on the second floor of the building at least 8 m above ground level. There were other entry / exit cavities sighted, but most of these were quite large and showed evidence of use by pigeons or other birds and were not considered likely to be used by microbats.

Photos of the five potential roost entry and exit points appear in Appendix A.

5.2 Weather

The weather experienced during the surveys was suitable for microbats to be active and details of temperature and rainfall are listed in Table 1.

Table 2: Survey temperatures and rainfall

Survey Date	Max Temperature	Min Temperature	Rainfall (mm)
25 September 2019	21.9	9.7	0
26 September 2019	20.8	12.6	0
27 September 2019	25.3	13.9	0
28 September 2019	21.7	15.3	0
29 September 2019	21.21	11.3	0
17 February 2020	25.3	20.8	1.2
18 February 2020	29.4	20.5	0.4
20 February 2020	25.6	18.2	0.2
21 February 2020	25.3	20.1	0

5.3 Ultrasonic detection survey

5.3.1 September 2019

A total of 25 ultrasonic survey nights were recorded across the five potential entry / exit points between 25 and 29 September 2019. Survey took place outside the RHI, looking across four of the five potential entry/ exit points, with survey of the fifth potential entry/exit point (the turret) occurring inside the RHI.

Results from the September 2019 surveys at each of the survey locations are presented in Table 4 to Table 7.

Table 3: Microbat species and number of calls recorded at potential roost entry / exit 1, Door 7, 25 – 29 September 2019

Scientific Name	Common Name	Definitely present	Potentially present	Total calls
Chalinolobus gouldii / Ozimops ridei	Gould's Wattled Bat / Ride's Free-tailed Bat		1	1
Miniopterus orianae oceanensis	Large Bent-winged Bat	3		3
Unidentifiable				0
Total identifiable calls				4
Total calls recorded				4
Percentage identifiable calls				100%

Table 4: Microbat species and number of calls recorded at potential roost entry / exit 2, Door 8, 25 – 29 September 2019

Scientific Name	Common Name	Definitely present	Potentially present	Total calls
Austronomus australis	White-striped Free-tailed Bat			1
Chalinolobus gouldii	Gould's Wattled Bat			1
Miniopterus orianae oceanensis	Large Bent-winged Bat	11		11
Unidentifiable				1
Total identifiable calls				13
Total calls recorded				14
Percentage identifiable calls				93%

Table 5: Microbat species and number of calls recorded at potential roost entry / exit point 3, outside the south- eastern wall, 25 – 29 September 2019

Scientific Name	Common Name	Definitely present	Potentially present	Total calls
Austronomus australis	White-striped Free-tailed Bat	1		1
Chalinolobus gouldii	Gould's Wattled Bat	1	1	2

Scientific Name	Common Name	Definitely present	Potentially present	Total calls
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	3		3
Unidentifiable				0
Total identifiable calls				6
Total calls recorded				6
Percentage identifiable calls				100%

Table 6: Microbat species and number of calls recorded at potential roost entry / exit point 4, outside the eastern turret, 25 – 29 September 2019

Scientific Name	Common Name	Definitely present	Potentially present	Number
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	2		2
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	4		4
Unidentifiable				3
Total identifiable calls				6
Total calls recorded				9
Percentage identifiable calls				67%

There were no calls recorded at potential roost entry / exit point 5, inside the eastern turret between 25 and 29 September 2019.

There were 33 call sequences recorded during this survey. All call sequences were recorded in close proximity to the outside of the RHI building; no calls were recorded inside the RHI building. Of these, 29 (88%) were deemed useful, because the call profile was of sufficient quality and/or length to enable positive identification of bat species. The remaining four (12%) call sequences were either too short or of low quality, thus preventing positive identification of bat species.

There were at least three and up to four species identified during the survey; including one species listed as vulnerable under the *Biodiversity Conservation Act 2016* (BC Act) (Table 3) The threatened *Miniopterus orianae oceanensis* (Large Bent-winged Bat) was definitely present on site. No species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were identified. Calls from the Large Bent-winged Bat were the most commonly recorded during the survey, and they accounted for 21 of the 33 calls that were recorded; accounting for 64% of the positively identified call sequences.

Table 7: Microbat species and number of calls recorded at the RHI between 25 -29 September 2019.

Scientific Name	Common Name	Present	BC Act status	EPBC Act status	Total calls
<i>Austronomus australis</i>	White-striped Free-tailed Bat	Definitely	Not listed	Not listed	2

Scientific Name	Common Name	Present	BC Act status	EPBC Act status	Total calls
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	Definitely	Not listed	Not listed	5
<i>Chalinolobus gouldii</i> / <i>Ozimops ridei</i>	Gould's Wattled Bat / Ride's Free-tailed Bat	Potentially	Not Listed	Not listed	1
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	Definitely	Vulnerable	Not listed	21
Unidentifiable					4
Total identifiable calls					29
Total calls recorded					33
Percentage identifiable calls					88%

Microbat activity at the site was extremely low with a microbat call recorded roughly every 9 hours of recording time on average throughout the 23 nights (276 hours) of survey. It is also likely that the same bat was recorded on multiple Anabat units during each recording session because of the proximity of Anabat detectors to each other, which may have inflated the actual activity levels. There were very few long sequences recorded during the survey indicating that microbats were predominantly commuting past the site. There were no feeding buzzes recorded in the data.

Most calls (25 out 33 (81%)) were recorded between the hours of 10:00 pm and 4:00 am and it is likely that these calls were made by bats flying past the site. The earliest call that was recorded in the evening was at 8:15 p.m. on a detector set beneath potential entry / exit point 1 (Door 7) on 26 September 2019 and was made by either a *Chalinolobus gouldii* (Gould's Wattled Bat) or *Ozimops ridei* (Ride's Free-tailed Bat). Calls of these two species overlap and can be difficult to separate if defining characteristics are not present.

There were three calls recorded between 5:30 a.m. and 6:10 a.m. on 27 September at potential entry / exit point 2 (Door 8) made by the Large Bent-winged Bat. These calls indicate that the Large Bent-winged Bat could be roosting very close by and potentially within the RHI.

5.3.2 Ultrasonic detection survey - February 2020

A total of 20 ultrasonic detection hours was recorded from the five potential roost entry / exit points during the February 2020 surveys. There were six call sequences recorded during this survey. Of these, three (50%) were deemed useful because the call profile was of sufficient quality and / or length to enable positive identification of bat species. The remaining three (50%) call sequences were either too short or of low quality preventing positive identification of bat species.

At least one and up to two species were recorded during this survey (Table 8). *Chalinolobus gouldii* (Gould's Wattled Bat) was definitely present and *Ozimops ridei* (Ride's Free-tailed Bat) was potentially present. Calls of these two species overlap and can be difficult to separate if defining characteristics are not present. All three calls recorded during the survey in February 2020 were from potential roost entry / exit 1 (Door 7) on 18 February. None of the recorded calls correspond with the time that a suspected microbat was observed emerging from potential roost entry / exit point 1 (Door 7) on 18 February 2020.

No species listed under the EPBC Act or the BC Act were identified in the data recorded during the February ultrasonic surveys. Calls from Gould's Wattled Bat were the most commonly recorded during the survey, and they accounted for two of the three calls that were recorded; accounting for 66.6% of the positively identified call sequences.

Microbat activity at the site was low with a microbat call recorded roughly every 3 hours on average throughout the 20 hour survey period. There were no long sequences recorded during the survey indicating that microbats were predominantly commuting past the site. There were no feeding buzzes recorded in the data.

Table 8: Microbat species and number of calls recorded at the RHI between 17-18 and 20-21 February 2020.

Scientific Name	Common Name	Present	BC Act status	EPBC Act status	Total calls
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	Potentially	Not listed	Not listed	2
<i>Chalinolobus gouldii</i> / <i>Ozimops ridei</i>	Gould's Wattled Bat / Ride's Free-tailed Bat	Potentially	Not Listed	Not listed	1
Unidentifiable					3
Total identifiable calls					3
Total calls recorded					6
Percentage identifiable calls					50%

5.3.3 Ultrasonic call analysis limitations

Calls were only positively identified when the defining characteristics were present and there was no chance of confusion between species with overlapping and/or similar calls. In this survey, there were some call sequences that could not be positively identified to species level. Further, some species recorded in this survey can have call profiles that overlap with other species. When overlap occurs, species with similar call profiles are assigned to multi species groups of two or three potential species depending on the characteristics displayed in the recorded call sequences. Calls with intermediate characteristics were assigned mixed species labels.

The species recorded in this survey with overlapping call profiles are described below.

Gould's Wattled Bat and Ride's Free-tailed Bat have calls that overlap in the range 28.5 kHz and 33 kHz. Free-tailed Bat species calls are flat in shape with an initial slope (S1) of less than 100 octaves per second (OPS) separating them from Gould's Wattled Bat whose calls are curved with an S1 greater than 200 OPS. Gould's Wattled Bat was distinguished by a frequency of 27.5 – 32.5 kHz and alternation in call frequency between pulses. There were two call sequences recorded which did not show any alternation in call frequency and had an OPS between 100 and 200 and these calls were labelled as Gould's Wattled Bat / Ride's Free-tailed Bat.

Large Bent-winged Bat calls overlap in frequency with those of *Vespadelus regulus* (Southern Forest Bat) and *V. darlingtoni* (Large Forest Bat) in the Sydney Basin. The calls of Large Bent-winged Bats can be separated from the Forest Bats by a down-sweeping tail which neither of the Forest Bats displays (generally being up-sweeping or absent). Large Bent-winged Bat calls are often variable in pulse shape and time between pulses whereas the Forest Bats commonly have regular pulses evenly spaced pulses. There were no calls that displayed the characteristics of the Large or Southern Forest Bat.

5.4 Emergence surveys

There were observations of microbats not associated with the potential roost entry / exit points at the RHI flying overhead on all survey nights during September 2019 and February 2020. There were several observations of animals using the cavities of the RHI during surveys. A large bird was observed flying into potential roost entry / exit 5 at 8.15 p.m. on 17 February 2020. This animal was suspected to be a *Columba livia* (Feral Pigeon), several of which are known to roost within the RHI. Two observations of *Rattus* spp., likely *Rattus rattus* (Black Rat) entering potential roost entry / exit 3 were made at 7.53 p.m. and 8.15 p.m. on 17 February 2020. Rats are known to nest inside the RHI and there are rat baits inside the building. Several *Trichoglossus moluccanus* (Rainbow Lorikeets) were seen entering potential roost entry / exit 3 at 7.30 p.m. on 20 February 2020.

The only observation of a likely microbat emerging from one of the potential entry / exit points occurred at 8.33 p.m. on 18 February 2020 at potential roost entry / exit 1 (Door 7). A single microbat was observed crawling out of the cavity and down the wall before flying directly upwards. Images of this event were captured on a thermal imaging camera and are described in Section 3.5 below.

5.5 Thermal imaging surveys

An animal believed to be a microbat was observed emerging at potential roost entry / exit 1 (Door 7) at 8.33 p.m. on 18 February 2020. The emergence was captured using a FLIR E75 thermal imaging camera and the two recorded images can be found in Appendix C. No corresponding microbat calls were captured on the detector at this location at this time to enable identification of the animal to a particular microbat species. While it is not possible to be 100% certain that the animal observed using the thermal imaging camera was a microbat, there are several lines of evidence which would suggest that it was:

- the time of emergence of the animal from the RHI (8.33 p.m.) coincided with the prime emergence time of microbats leaving roosts to forage for the evening and was after bird activity had ceased for the day
- the low light levels at the time of emergence suggest the animal was a nocturnally adapted species
- the size of the animal matches with the expected size of a microbat, but could also correlate with the size of a small bird
- the animal was observed to move / crawl slowly down the wall of the RHI beneath the cavity before flying directly upwards, a behaviour pattern that is more commonly observed in microbats rather than birds.

6. Interpretation of survey results

6.1.1 Presence of microbat roosting habitat

One of the five potential microbat roost entry/exits to the RHI (location 3) was identified to contain a rat and was considered unsuitable for microbat use. One (location 1), has been positively confirmed as a microbat roost entry / exit point from observations made of a single unidentified microbat emerging on 18 February 2020. Though no microbats were observed emerging from the remaining three potential microbat roost entry/exits, they are considered as suitable to provide potential microbat roost entry / exit points to the RHI.

Cavities in the RHI contain microbat habitat and may be used by a range of microbat species (and other fauna) throughout the year.

6.1.2 Significance of roosts

Relative microbat activity as measured using ultrasonic call recording at the site varied from low to extremely low. It was clear from emergence surveys, ultrasonic surveys and thermal imaging surveys that the cavities within the RHI do not support a significant breeding colony of any microbat species. Moderate to high levels of microbat activity would be expected outside breeding roosts if surveyed in suitable weather conditions over the spring summer breeding period.

Because microbat roosting habitat is present at the RHI, there is a chance that the threatened Large Bent-winged Bat, or other threatened microbat species not recorded during this survey but known to be present in the Sydney Basin (refer to Section 3) use cavities within the RHI as winter / hibernation roost habitat.

6.1.3 Presence of threatened microbat species

The Large Bent-winged Bat was the only threatened microbat species recorded on site. Large Bent-winged Bats (along with other threatened and non-threatened microbat species) are likely to forage in proximity to the RHI building, including in adjacent Moore Park and Centennial Park.

Large Bent-winged Bats are subterranean roosting species. Large Bent-winged Bats congregate in large numbers at a few known maternity caves outside of the Sydney Basin over spring and summer to breed and raise young and disperse to winter hibernation roosts up to 300 km away from maternity roosts in autumn (Churchill, 2008). This species is known to inhabit the Sydney Basin throughout the winter months with some non-breeding individuals remaining in the area throughout the year. There are multiple Large Bent-winged Bat records in Bionet within a 10 km radius of the study area.

The RHI is not a breeding habitat for Large Bent-winged Bats, as this species is not known to breed in buildings. Also, large aggregations (1000s) of Large Bent-winged Bats are required to sustain a maternity roost. Therefore, it would be obvious within or outside the RHI, if the subject site was being used as a breeding roost for this species.

Calls from the Large Bent-winged Bat were the most commonly recorded calls obtained during the September 2019 ultrasonic surveys, even though activity from this and all species was extremely low. There were no Large Bent-winged Bat calls recorded prior to 10.00 p.m. but there were three Large Bent-winged Bat calls recorded in the period just prior to dawn suggesting that a single or small number

of individual Large Bent-winged Bats was roosting nearby and potentially within cavities of the RHI. There were no Large Bent-winged Bat calls recorded during the February 2020 ultrasonic surveys.

7. Conclusions and recommendations

The RHI may provide potential roosting habitat for the following threatened microbat species:

- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Miniopterus australis* (Little Bentwing-bat)
- *Miniopterus norfolkensis* (Eastern Free-tailed Bat)
- *Miniopterus schreibersii oceanensis* (Large Bentwing-bat).

However, the survey only positively identified calls of one threatened microbat species, the Large Bentwing-bat, as well as calls of up to three non-threatened microbat species.

The Large Bent-winged Bat is a species listed as Vulnerable under the BC Act. Under the BC Act, the Large Bent-winged Bat is a dual credit species (an ecosystem credit and species credit species), but it is a species credit species for breeding habitat only.

This report identified that the RHI is not breeding habitat for Large Bent-winged Bats. This is because this species is not known to breed in buildings and no evidence of large aggregations (1000s) of Large Bent-winged Bats (required to sustain a maternity roost) has been found at the RHI.

No Large Bent-winged Bats were confidently identified during the emergence surveys or thermal imaging surveys. A single unidentified likely microbat was observed emerging from a roost within one roost entry / exit (Door 7) and the survey findings indicate that Large Bent-winged Bats forage in proximity to the RHI building. Therefore, it is possible that individuals or small numbers of Large Bent-winged Bats use the RHI as roosting habitat.



Therefore, the proposed development may have the following potential prescribed biodiversity impact on this species:




- [impacts to] human-made structures which is used as a habitat feature by a threatened species.

A Biodiversity Development Assessment Report (BDAR) has been prepared to assess prescribed biodiversity impacts for threatened species, as well as impact on native vegetation and habitat for threatened species, consistent with the Biodiversity Assessment Method (BAM).

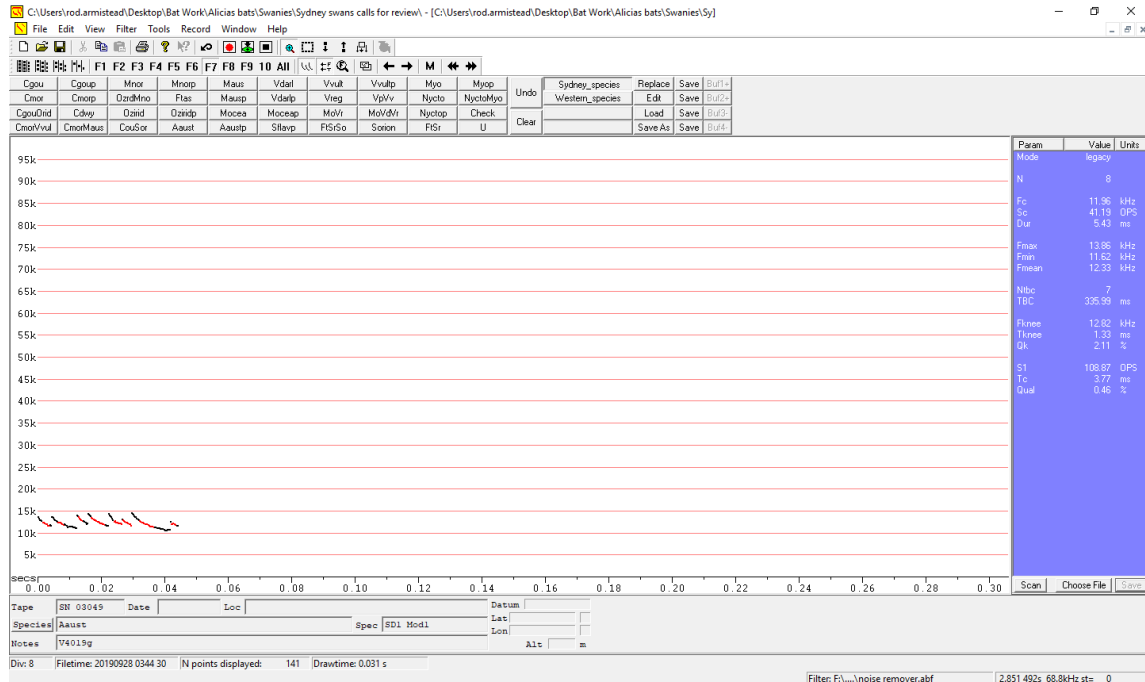
In conjunction with the preparation of the BDAR, a Microbat Management Plan (MMP) has been prepared to outline steps required to avoid, minimise and mitigate against potential impacts to microbats associated with the proposed roof replacement and building refurbishment proposed to occur at the RHI. The MMP describes the process of excluding microbats from the cavities within the RHI prior to commencement of works, including provision of a timeline for each action required under the MMP so that impacts to target threatened microbat species that may be affected by loss of non-breeding roost spaces occur at the least sensitive times of year for those microbat species.

Appendix A : Microbat survey location photos

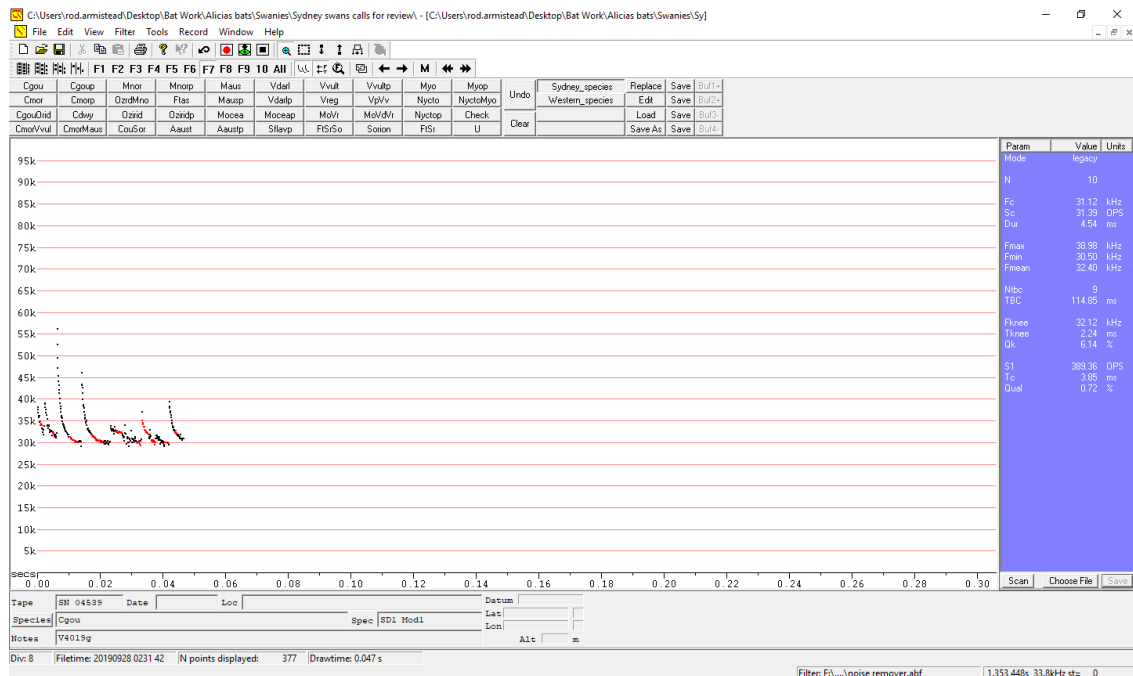
Anabat survey location	Photo	Survey finding
1: Near Door 7		Likely bat emergence from this location. Definite microbat roost entry/exit.
2: Near Door 8		Potential microbat roost entry/exit.

Anabat survey location	Photo	Survey finding
3: South-eastern facade		Rodent (likely rat) and Rainbow Lorrikeets seen within cavity. Not considered a potential microbat roost entry/exit
4: Eastern turret and facade		Considered a potential microbat roost entry/ exit
5: Inside eastern turret		Considered a potential microbat roost

Appendix B Examples of Call Profiles



Call profile for *Austronomus australis* (White-striped Free-tailed Bat) recorded beneath Door 8 of the Royal Hall of Industries at 03:44 (3:44 am) on 28 September 2019.



Call profile for *Chalinolobus gouldii* (Gould's Wattled Bat) recorded outside the Turret of the Royal Hall of Industries at 02:31 (2:31 am) on 28 September 2019.

C:\Users\rod.armistead\Desktop\Bat Work\Alicias bats\Swanies\sydney swans calls for review\ - [C:\Users\rod.armistead\Desktop\Bat Work\Alicias bats\Swanies\Sy]

File Edit View Filter Tools Record Window Help

F1 F2 F3 F4 F5 F6 F7 F8 F9 10 All

 M

Cgou	Cgou	Mnor	Mnor	Maus	Vdal	Vvult	Vvult	Myo	Myp	Undo	Sydney_species	Replace	Save	Buf1
Cmor	Cmor	Ozdm	Ozdm	Flas	Mausp	Vdalp	Vreg	VpVv	Nycto	NyctoMyp	Western_species	Edit	Save	Buf2
CgouOrd	Cdwy	Ozid	Ozidp	Mocea	Mocep	MoVr	MoVdVr	Nyctop	Check	Clear		Load	Save	Buf3
CmorVul	CmorMaus	CouSor	Aust	Austp	Silavp	FISo	Sorion	FISr	U			Save As	Save	Buf4

Param Value Units

Mode	legacy	
N	20	
Fc	45.74	kHz
Sc	26.26	OPS
Dur	4.01	ms
Fmax	52.55	kHz
Fmin	45.42	kHz
Fmean	47.33	kHz
Nbfc	19	
TBC	55.72	ms
F100%	47.67	kHz
T100%	1.02	ms
Gk	3.35	%
S1	235.62	OPS
Tc	3.75	ms
Qual	0.30	%

Scan Choose File Save

Type SW 03045 Date Loc Datum

Species Moceanpx Spec SD1 Mod1 Lat

Notes V4019g Lon Alt m

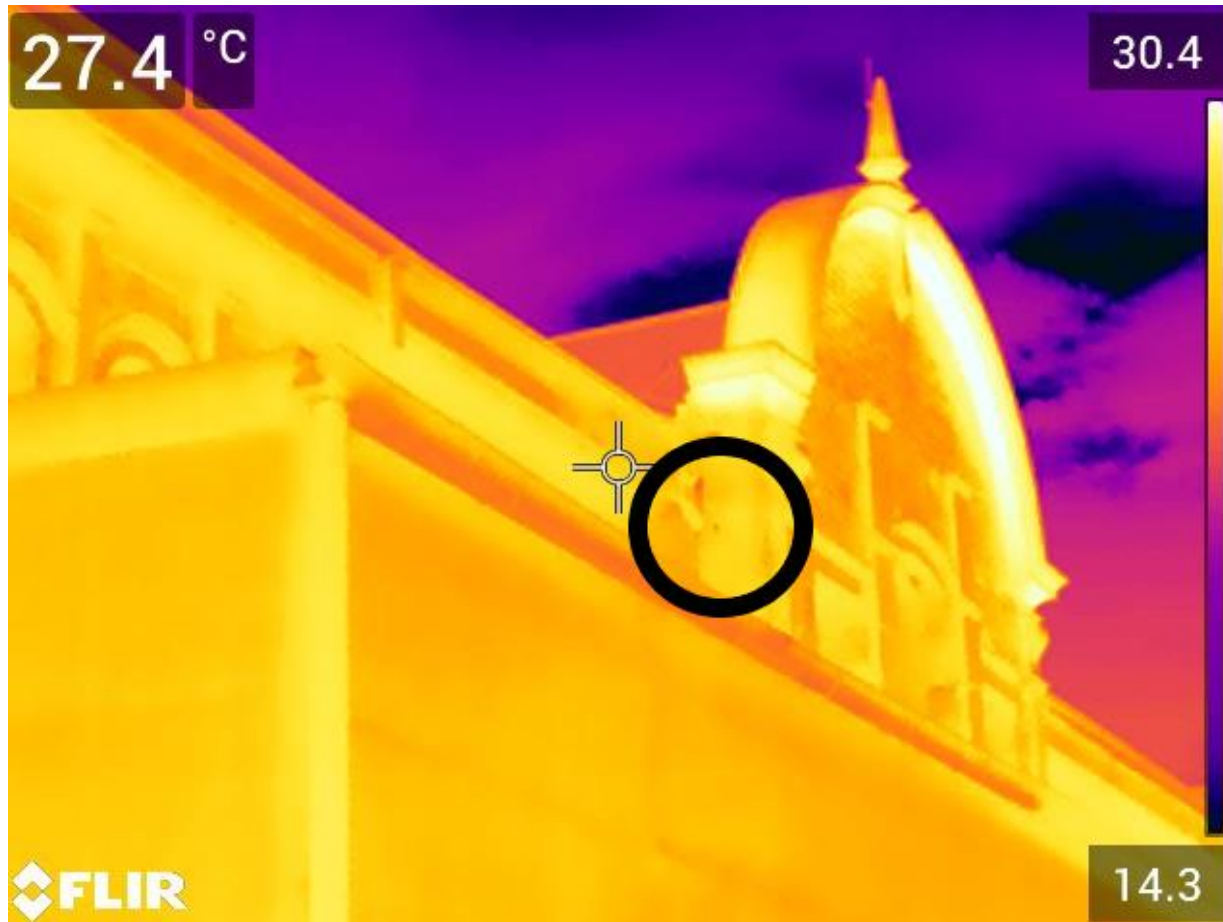
Div:8 Filetime: 20190928 0543 17 N points displayed: 961 Drawtime: 0.031 s

Filter: Fx\...\noise remover.afx 2.620.636s 21.8kHz st= 0

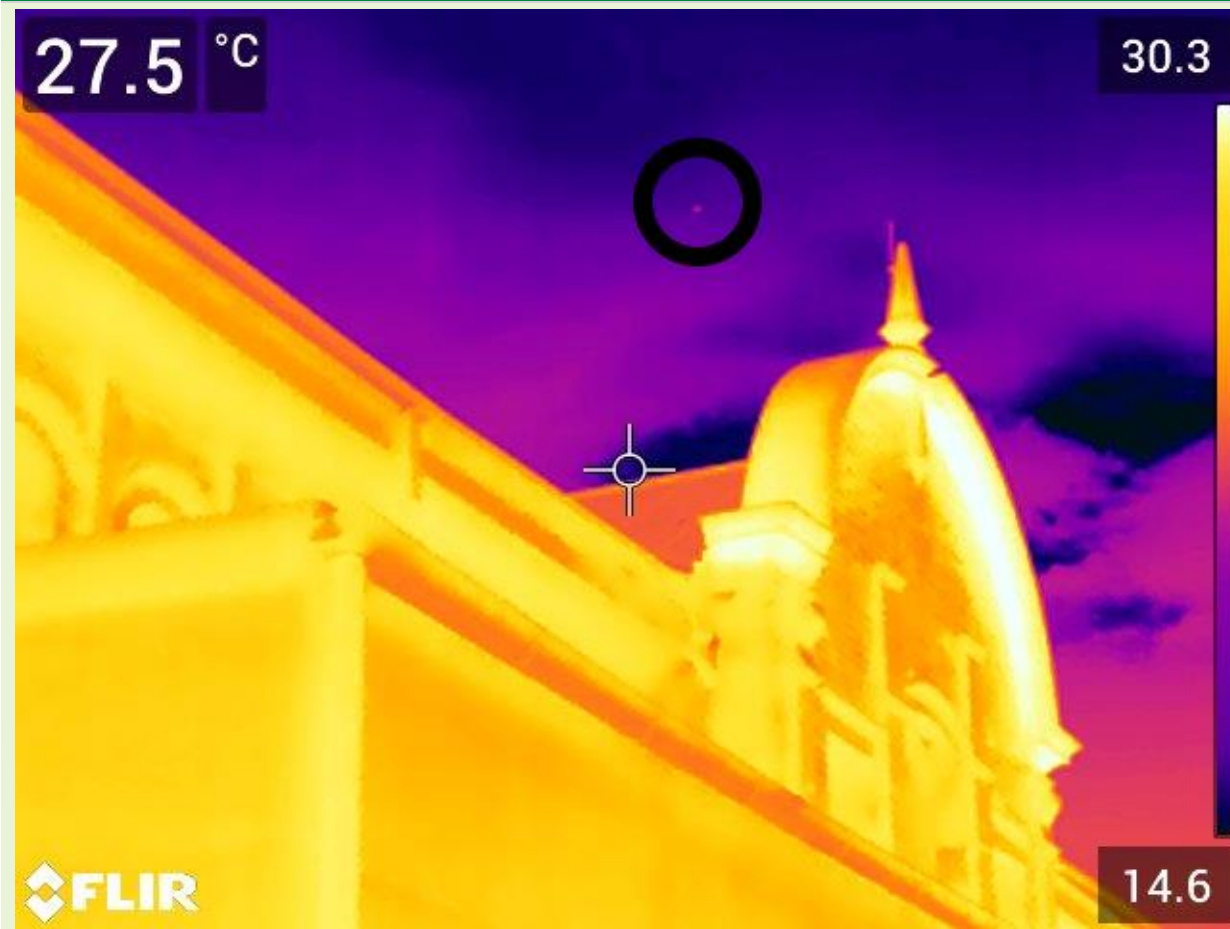
18

Appendix C Infrared thermal camera images of likely bat emergence

Infrared thermal camera image of likely bat emergence at Location 1 (door 7) on 18/02/2020 at 20.33



Infrared thermal camera image of likely bat emergence at Location 1 (door 7) on 18/02/2020 at 20.33



8. References

- Churchill, S. (2008). *Australian Bats*. Second Edition. Allen & Unwin, Crows Nest, Sydney.
- Glynn, A. (2020). Memorandum: Microbats in the Centennial Parklands. From Amara Glynn, Environmental Officer Centennial Parklands to Anthony Murphy, Senior Project Manager APP, 13 Feb 2020
- Jackson, C. and Groves, S. (2015). *Taxonomy of Australian Mammals*. CSIRO Publishing.
- Law, B. S., Anderson, J., and Chidel, M. (1999). 'Bat communities in a fragmented forest landscape on the south-west slopes of New South Wales, Australia'. *Biological Conservation* 88, 333-345.
- Lloyd, A.M., Law, B.S., and Goldingay, R. (2006) 'Bat activity on riparian zones and upper slopes in Australian timber production forests and the effectiveness of riparian buffers.' *Biological Conservation* 129, 207-220.
- McKenzie, N. L., Start, A. N., and Bullen, R. D. (2002). *Foraging ecology and organisation of a desert bat fauna*. Australian Journal of Zoology 50, 529-548.
- Mills, D. J., Norton, T. W., Parnaby, H. E., Cunningham, R. B., and Nix, H. A. (1996). *Designing surveys for microchiropteran bats in complex forest landscapes - a pilot study from south-east Australia*. Special issue: Conservation of biological diversity in temperate and boreal forest ecosystems 85, 149-161.
- Pennay, M., Law, B., and Reinhold, L. (2004). *Bat calls of New South Wales: Region based guide to echolocation calls of Microchiropteran bats*. NSW Department of Environment and Conservation, Hurstville.
- Reardon, T.B., McKenzie, N.L., Cooper, S.J.B., Appleton, B., Carthew, S. and Adams, M. (2014). A molecular and morphological investigation of species boundaries and phylogenetic relationships in Australian free-tailed bats *Mormopterus* (Chiroptera: Molossidae). Australian Journal of Zoology 62: 109 – 136.
- Reinhold, L., Law, B., Ford, G., and Pennay, M. (2001). *Key to the bat calls of south-east Queensland and north-east New South Wales*. 2001. Queensland, DNR.



Appendix D: Microbat Management Plan

A stylized topographic map with green contour lines is positioned on the left side of the page, extending from the top left towards the bottom left.

Sydney Swans Headquarters, Moore Park Microbat Management Plan

APP Corporation Pty Limited

DOCUMENT TRACKING

Project Name	Sydney Swans Headquarters, Moore Park Microbat Management Plan
Project Number	19SUT-12417
Project Manager	Kirsten Velthuis
Prepared by	Dee Ryder and Kirsten Velthuis
Reviewed by	Alicia Scanlon
Approved by	Meredith Henderson
Status	Final
Version Number	1
Last saved on	10 March 2020

This report should be cited as 'Eco Logical Australia 2020. *Sydney Swans Headquarters, Moore Park Microbat Management Plan* . Prepared for APP Corporation Pty Limited .'

Disclaimer

This document may only be used for the purpose for which it was commissioned and in accordance with the contract between Eco Logical Australia Pty Ltd and APP Corporation Pty Limited . The scope of services was defined in consultation with APP Corporation Pty Limited , by time and budgetary constraints imposed by the client, and the availability of reports and other data on the subject area. Changes to available information, legislation and schedules are made on an ongoing basis and readers should obtain up to date information. Eco Logical Australia Pty Ltd accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report and its supporting material by any third party. Information provided is not intended to be a substitute for site specific assessment or legal advice in relation to any matter. Unauthorised use of this report in any form is prohibited.

Template 2.8.1

Contents

Introduction	5
1.1 Background.....	5
1.2 Scope of Works	5
1.3 Objective and Aims	6
2. Microbat survey and roost assessment.....	8
3. Microbat Management	15
3.1 Approach	15
3.2 Compensatory Habitat – Bat Boxes	15
3.2.1 Bat box design and installation	16
3.3 Exclusion Timing	17
3.4 Roost Exclusion Methodology	17
3.4.1 Exclusion Process	17
3.4.2 Exclusion devices	18
3.4.3 Inspection and maintenance of exclusion devices	18
3.5 Actions during construction.....	19
3.5.1 Site induction	19
3.5.2 Daily Inspection.....	20
4. Contingency Measures.....	22
4.1 Adaptive Procedures.....	22
4.2 Capturing and releasing healthy microbats	22
4.3 Injured or dead microbats	23
5. Risks.....	24
5.1 Exposure to diseases such as Australian Bat Lyssavirus.....	24
6. Roles and Responsibilities.....	25
7. Reporting and Communication.....	27
8. Monitoring	29
8.1 Monitoring methodology.....	29
8.2 Performance measures.....	29
8.3 Monitoring report.....	30
9. Reference List.....	31
Appendix A Potential microbat roost entry/exit location photos	32

List of Figures

Figure 1: The subject site	6
Figure 2: Subject site showing survey locations.....	14
Figure 3: <i>Miniopterus orianae oceanensis</i> Large Bent-winged Bats	19
Figure 4: <i>Miniopterus australis</i> Little Bent-winged Bats	20

List of Tables

Table 1: Ecology and life history characteristics of seven threatened microbat species known to occur within a 10 km radius of the Subject site and likelihood of impacts	9
Table 2: Microbat species recorded at RHI during ultrasonic detection surveys conducted in September 2019 and February 2020	11
Table 3: Conservation habitat value category criteria for microbat roosting habitat within cavities of the RHI	13
Table 4: Action log summary table to be included in the final report	27

Abbreviations

Abbreviation	Description
ABLV	Australian Bat Lyssavirus
APP	APP Corporation Pty Limited
BC Act	<i>Biodiversity Conservation Act 2016</i>
BDAR	Biodiversity Development Assessment Report
CEMP	Construction Environmental Management Plan
ELA	Eco Logical Australia
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EP&A Act	<i>Environment Planning and Assessment Act 1979</i>
GPS	Global Positioning System
MMP	Microbat Management Plan
NPWS	National Parks & Wildlife Service
OEH	Office of Environment & Heritage
PPE	Personal Protective Equipment
RHI	Royal Hall of Industries
SEMP	Site Environmental Management Plan
SSD	State Significant Development
SWMS	Safe Work Method Statement

1. Introduction

1.1 Background

Eco Logical Australia (ELA) have been engaged by APP Corporation Pty Limited (APP), on behalf of the Sydney Swans, to prepare a Microbat Management Plan (MMP) for the proposed adaptive reuse of the Royal Hall of Industries (RHI) building for a high-performance sport and community facility for the Sydney Swans at 1 Driver Street in Moore Park, Sydney (the Subject site).

The proposed adaptive reuse of the RHI is identified State Significant Development (SSD-9726) in accordance with the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). Eco Logical Australia (ELA) has prepared a Biodiversity Development Assessment Report (BDAR) and a Microbat Survey Report, which identifies the potential for the RHI to provide non-breeding roosting habitat for threatened microbats. The proposed works include replacement of the existing roof, gutters and fascia which contain cavities used as microbat habitat. Impacts to the RHI are considered a prescribed biodiversity impact.

Based on the above, and on recommendations by the Environment, Energy and Science Group (EES) of Department of Planning, Industry and Environment, this MMP is required to manage risks to microbats prior to, during and post construction works.

1.2 Scope of Works

The Subject site is located at 1 Driver Avenue, Moore Park and consists of the RHI, and the associated courtyard area to the immediate south of the building (Figure 1). The site is owned by the Centennial Park and Moore Park Trust and is leased to the Sydney Swans for the purposes of the development. The RHI is situated within the Entertainment Quarter, and immediately adjacent to the Hordern Pavillion live music venue. The RHI has been used intermittently for large music and cultural / arts events up to May 2019. Noise, light, vibration and general disturbance from these events would disturb any microbats roosting within cavities of the RHI during any events, especially events that commence during daylight hours when microbats are at rest.

Despite the intermittent occurrence of live music, cultural and arts events at the RHI up until May 2019, microbats are known to use cavities within the RHI as non-breeding roosting habitat. Microbats change roosts regularly and rely on a series of roosts within their foraging range and are therefore able to select appropriate roosts based on the prevailing circumstances each evening. Without an itemised list of events held at the RHI it is difficult to determine the level of disturbance that may occur from events held there. However, it has been assumed that in the recent past (last 5 years), the RHI has been unused by humans the majority of the time (>70%) each year, providing ample disturbance free time for microbats to select cavities within the RHI as roosting habitat.

The development will largely maintain the structural integrity and façade of the RHI, whilst re-purposing the interior of the building to support several compatible uses and utilise the space effectively. In addition to the repurposing of the RHI, an extension of the building will be constructed to the south of the building in the current service and courtyard area and will include a pool and other infrastructure such as a netball centre. Actions proposed to be conducted to the roof structure of the RHI to complete these works include:

- Replace existing roof sheeting, gutters, fascia
- Demolition and removal of all redundant mechanical equipment

- Install scaffolding around the perimeter of RHI
- Investigate / measure skylights
- Modify roof structure for skylights/installation of aluminium sections
- Install skylights
- Reglaze external windows and restore RHI façade.

Vegetated areas of the development site consist of a small area of planted native (0.009 ha) and exotic vegetation (0.002 ha) along the road edge. Impact to vegetated areas include:

- Removal of four immature, native Spotted Gums (*Corymbia maculata*)
- Trimming of the following exotic vegetation: 20% foliage canopy of one Jacaranda (*Jacaranda mimosifolia*) and 13% of one Liquidambar (*Liquidambar styraciflua*)

The impacted vegetation does not contain hollows suitable for use by microbats.



Figure 1: The subject site

1.3 Objective and Aims

The overarching objective of this MMP is to minimise impacts to threatened microbats as a result of the proposed adaptive reuse of the RHI which could have the potential to affect microbats in the following ways:

- death / injury of individual bats during works – roosting bats can be easily overlooked during the day and will often remain in a roost when threatened during daylight hours rather than risk predation by flying and searching for other roosts during daylight
- loss of roosting habitat – reduction in the amount of suitable roosting habitat locally available may lead to increased competition / overcrowding of remaining roosting resources

- disturbance during works – excessive noise (especially high pitched), dust and vibrations above the general background levels will cause bats to arouse more often during daylight when they would normally be resting, reducing energy reserves and possibly leading to starvation and death.

This MMP aims to:

- Identify microbats, including threatened species listed under the *Biodiversity Conservation* (BC) Act 2016 or the *Environmental Protection and Biodiversity Conservation* (EPBC) Act 1999, known or found likely to occur on site that may be potentially impacted by works.
- Reduce the potential for death or injury to microbats as a result of the proposed works by planning works for the least sensitive time of year for the affected species and excluding microbats from the RHI prior to works.
- Provide details of the exclusion procedures and other management measures required to safeguard microbats and minimise impacts to microbats for the duration of the works.
- Identify possible risks to construction personnel and outline procedures for mitigating those risks and dealing with unexpected microbat finds during proposed works.
- Identify monitoring and reporting requirements and responsibilities with respect to the actions outlined in this MMP.

2. Microbat survey and roost assessment

During September 2019 and February 2020, ELA undertook targeted surveys of potential microbat roosts within the Subject site consistent with the '*Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Methodology* (OEH 2018). Potential roosts within the subject site included five cavities in the façade of the building comprising areas where drainage pipes are attached and run into decorative external features, there is degraded timber / plasterboard fascia on / under the eaves and guttering and missing brickwork on the internal turret walls (Appendix A). The aim of targeted microbat surveys was to determine if bats were present, identify the species present, quantify the number of roosting bats, and the potential carrying capacity of the roosts within each potential roost.

The threatened microbat species targeted during the Subject site survey because they were known to occur within 10 km of the Subject site included;

- *Chalinolobus dwyeri* (Large-eared Pied Bat)
- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Micronomus norfolkensis* (Eastern Coastal Free-tailed Bat)
- *Miniopterus australis* (Little Bent-winged Bat)
- *Miniopterus orianae oceanensis* (Eastern Bent-winged Bat)
- *Myotis macropus* (Southern Myotis)
- *Saccolaimus flaviventris* (Yellow-bellied Sheath-tailed Bat).

Details about life history and ecology for each of the seven threatened species, number of records within a 10 km radius of the Subject site and an assessment of the likelihood of each species being impacted by proposed works at the RHI appears in Table 1. Of these seven threatened microbat species, four are considered to be potentially affected by proposed works at the RHI because they are known to roost in buildings or other artificial structures (Churchill 2008). The four potentially affected species are:

- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle,
- *Micronomus norfolkensis* (Eastern Coastal Free-tailed Bat)
- *Miniopterus australis* (Little Bent-winged Bat)
- *Miniopterus orianae oceanensis* (Eastern Bent-winged Bat).

Under the BC Act, the Large Bent-winged Bat and Little Bent-winged Bat are both dual credit species (ecosystem credit and species credit species), however species credits apply for breeding habitat only. In contrast both the Eastern Coastal Free-tailed Bat and Eastern False Pipistrelle are ecosystem credit species.

The Microbat Survey Report (ELA 2020) provides a detailed description of the survey methodology and the findings of targeted microbat surveys undertaken at the RHI in September 2019 and February 2020. Five potential microbat roost entry / exit points (Appendix A) were identified and surveyed by visual observation diurnally and nocturnally in conjunction with ultrasonic detection surveys and thermal imaging surveys over multiple nights during September 2019 and February 2020.

Table 1: Ecology and life history characteristics of seven threatened microbat species known to occur within a 10 km radius of the Subject site and likelihood of impacts

Scientific Name	Common Name	BC Act	EPBC Act	Distribution	Habitat requirements	Records within 10 km	Roost preference	Likelihood of impact
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Recorded from Rockhampton in Qld south to Ulladulla in NSW. Largest concentrations of populations occur in the sandstone escarpments of the Sydney basin and the NSW north-west slopes.	Wet and dry sclerophyll forests, Cyprus Pine dominated forest, woodland, sub-alpine woodland, edges of rainforests and sandstone outcrop country.	1	Subterranean	N/A. Not recorded ultrasonically during surveys for this report and not known to roost in buildings.
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V		South-east coast and ranges of Australia, from southern Qld to Victoria and Tasmania. In NSW, records extend to the western slopes of the Great Dividing Range.	Tall (greater than 20m) moist habitats.	1	Hollows / Buildings occasionally.	Potential. Not recorded ultrasonically during surveys for this report. Suitable but sub-optimal roosting and foraging habitat present.
<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	V		East-coast of NSW from south of Sydney into south-east Qld and east of the Great Dividing Range	Commonly occurs in dry eucalypt forests and woodlands east of the Great Dividing Range. Common on Cumberland Plain. Prefers open spaces in forest and woodland, more active on upper slopes of forested areas.	10	Hollows / Buildings / Telegraph poles / Exfoliating bark. Known to use bat boxes	Potential. Not recorded ultrasonically during surveys for this report but suitable foraging habitat present on site and suitable roosting habitat present within cavities of the RHI.
<i>Miniopterus australis</i>	Little Bent-winged Bat	V		East coast and ranges south to Wollongong in NSW.	Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub.	2	Subterranean / Buildings occasionally. Known to use bat boxes placed in subterranean	Potential Not recorded during surveys for this report but foraging habitat present within study area and may use cavities within the RHI for non-breeding roosting habitat.

Scientific Name	Common Name	BC Act	EPBC Act	Distribution	Habitat requirements	Records within 10 km	Roost preference	Likelihood of impact
							structures in small numbers.	
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	V		In NSW it occurs on both sides of the Great Dividing Range, from the coast inland to Moree, Dubbo and Wagga Wagga.	Rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland.	60	Subterranean / artificial structures. Known to use bat boxes placed in subterranean structures in small numbers.	Potential. Definitely recorded ultrasonically during surveys for this report and likely to forage over the study area. May use cavities in the RHI for roosting.
<i>Myotis macropus</i>	Southern Myotis	V		In NSW, found in the coastal band. It is rarely found more than 100 km inland, except along major rivers.	Foraging habitat is waterbodies (including streams, or lakes or reservoirs) and fringing areas of vegetation up to 20m. Rarely roosts more than 200 m from water.	35	Subterranean / Hollows	N/A Not recorded during surveys. RHI is too far from known foraging habitat on Sydney Harbour.
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tailed Bat	V		.	.	1	Hollows	N/A. Not recorded ultrasonically during surveys for this report and likely to forage over the study area. May roost in tree hollows nearby.

The calls of up to four species of microbats were recorded during ultrasonic surveys of the five potential microbat roost entry / exit points to the RHI (Table 2). This included calls of one threatened species listed as vulnerable under the BC Act 2016, the Large Bent-winged Bat. No calls of threatened species listed under the EPBC Act were recorded during ultrasonic surveys.

To assist in determining whether any bats utilise the cavities within the RHI as roosting habitat, a thermal camera survey was undertaken over two nights at each of the five potential microbat roost entry / exit points to the RHI during February 2020. One microbat was identified exiting potential microbat roost entry / exit point 1 (Door 7) during thermal imaging surveys, however no calls were recorded on the ultrasonic detection units at the time of the emergence and the species of microbat could not be determined.

Table 2: Microbat species recorded at RHI during ultrasonic detection surveys conducted in September 2019 and February 2020

Scientific Name	Common Name	Present	BC Act status	EPBC Act status
<i>Austronomus australis</i>	White-striped Free-tailed Bat	Definite	Not listed	Not listed
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	Definite	Not listed	Not listed
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	Definite	Vulnerable	Not listed
<i>Ozimops ridei</i>	Ride's Free-tailed Bat	Potential*	Not Listed	Not listed

*Calls overlap with Gould's Wattled Bat and no defining characteristics were present on recorded calls so species cannot be confirmed to be present

The Microbat Survey Report (ELA 2020) identified that four of the five cavities within the RHI are microbat roosting habitat (figure 2). The fifth cavity was found to contain rats and has been removed from the list of potential microbat roost sites. None of the surveyed cavities constitutes breeding habitat for Eastern Coastal Free-tailed Bats, Eastern False Pipistrelles, Large Bent-winged Bats, Little Bent-winged Bats or any other species of threatened or non-threatened microbat. This is because neither the Large Bent-winged Bat or the Little Bent-winged Bat is known to breed in buildings and no evidence of large aggregations (1000s) of Large or Little Bent-winged Bats (required to sustain a maternity roost) or any other microbat species was found during surveys at the RHI over the spring and summer microbat breeding season (ELA 2020).

Though none of the four potentially affected threatened microbat species were positively identified roosting within the cavities of the RHI during the surveys, it is possible that the single unidentified microbat observed emerging from microbat roost entry / exit point 1 (Door 7) on 18 February 2020 was one of these four threatened microbat species.

The Microbat Survey Report (ELA 2020) identified that Large Bent-winged Bats forage in proximity to the RHI and it is therefore possible that individuals or small numbers of Large Bent-winged Bats use the RHI as non-breeding roosting habitat. Although no other threatened microbat species known to roost in buildings was recorded during surveys it is also possible that individuals or small numbers of Eastern Coastal Free-tailed Bat, Eastern False Pipistrelle, and Little Bent-winged Bat also utilise the cavities within the RHI as non-breeding roosts from time to time throughout the year. There is therefore a risk that the proposed works will affect microbats.

Table 3 below provides guidelines, (adapted from the Woolgoogla to Ballina Microbat Management Plan, prepared by GeoLINK on behalf of the Roads and Maritime Services, 2015) for assigning microbat

roosting habitat into high, medium and low conservation value to allow appropriate measures to be taken to avoid, minimise and mitigate any impacts to microbat roosting habitat from proposed actions which may impact identified microbat roosting habitat. Based on the results gathered during targeted surveys in September 2019 and February 2020 summarised above, and the criteria presented in Table 3 below, the conservation habitat value of the cavities within the RHI is determined to be **medium**.

For the above reasons it is necessary to safely exclude microbats from the cavities within the RHI prior to commencement of works, and, to ensure impacts to microbats are minimised throughout the construction period. Construction works can only be undertaken once an ecologist with experience in microbat management has confirmed that the exclusion process is complete and is satisfied that the risk of harm to roosting microbats has been minimised as far as is practically possible in line with this MMP.

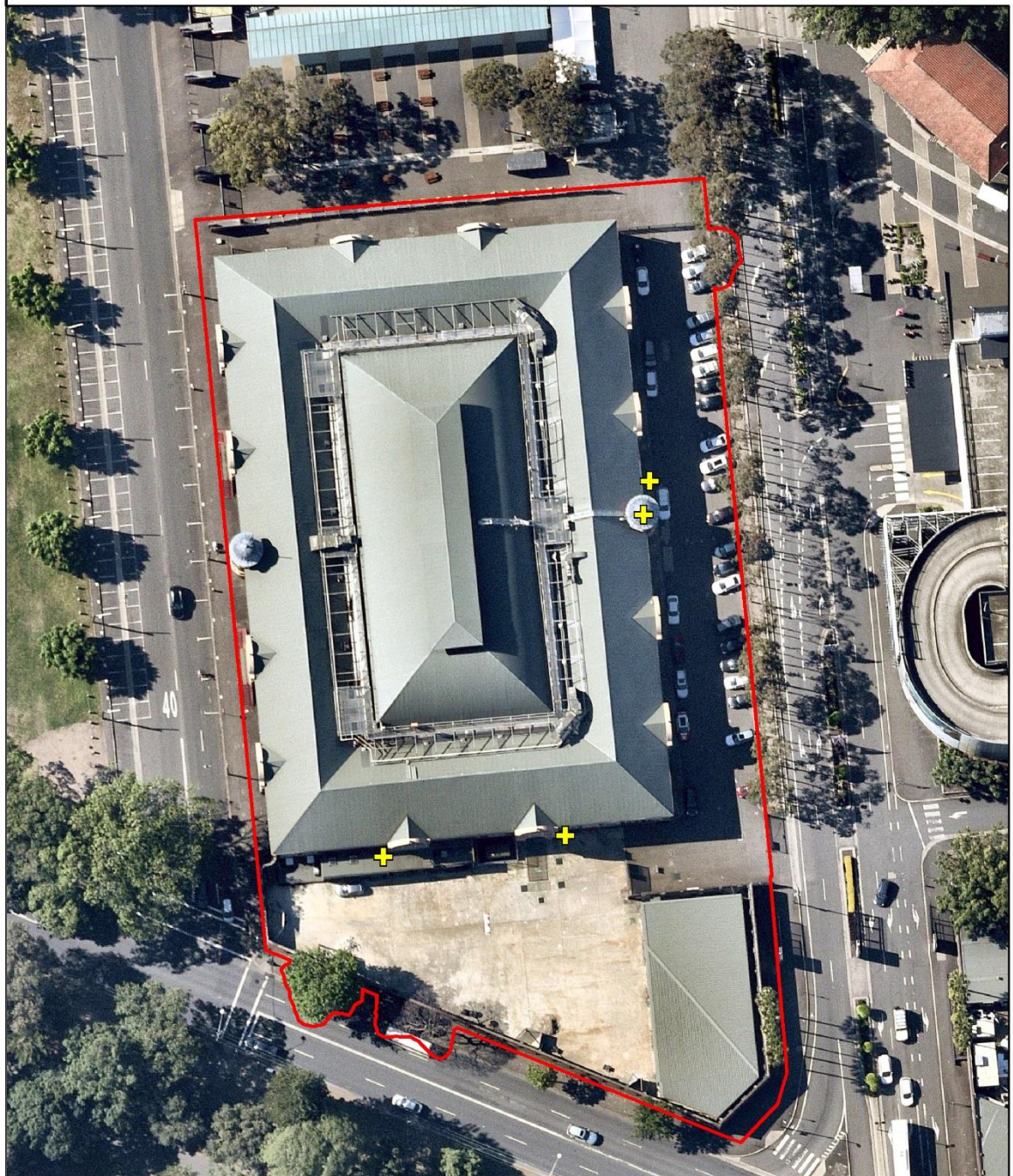
Table 3: Conservation habitat value category criteria for microbat roosting habitat within cavities of the RHI

Conservation Habitat Value	Criteria	RHI
High	<ul style="list-style-type: none"> Known to provide breeding habitat for threatened species; or Known to provide non-breeding roosting habitat for large numbers (ie.>50) of threatened species (e.g. known to support large numbers of Bent-wing-bats over winter); or Supports one or more of the federally listed threatened species 	<p>No.</p> <p>Surveys for this report did not record any threatened species breeding habitat in cavities of the RHI. There was no evidence to suggest that large numbers of bats (>50) use the cavities within the RHI. No federally listed microbat species were recorded during surveys and there is no suitable habitat present for the only federally listed species known to occur within a 10 km radius of the Subject site.</p>
Medium	<ul style="list-style-type: none"> Does not satisfy high conservation/ habitat value category; Provides non-breeding roosting habitat for small numbers (ie. <50) of threatened species; or Medium to large guano accumulations and/ or stains present indicative of the occurrence of moderate numbers of microbats or medium to long-term usage (threatened/ non-threatened status unknown); or Supports protected cavities providing good potential long term roosting habitat; however, no bats or evidence of roosting bats present; and/or In proximity to open surface water, however provides mainly exposed roosting opportunities (e.g. cavities <50 mm deep, or rough concrete), offering limited potential for breeding roosting; and/or Supports a breeding colony of non-threatened microbats. 	<p>Yes.</p> <p>Cavities within the RHI can provide non-breeding roosting habitat for small numbers (<50) of microbats including Large Bent-winged Bats. The RHI supports protected cavities providing good potential long-term microbat roosting habitat and evidence of a single unidentified microbat emerging from one of the cavities was obtained during surveys.</p>
Low	<ul style="list-style-type: none"> Does not satisfy high or medium conservation/ habitat value categories; and Individual microbats or very small numbers of non-breeding microbats (e.g. <5) present; or Small guano accumulations and/ or stains present indicative of the occurrence of small numbers of microbats or short-term usage; or Provides mainly exposed roosting opportunities (e.g. cavities <50 mm deep, or rough concrete) offering limited potential for use as breeding habitat; or Not in proximity to open water. Roosting habitat of similar value locally is common. 	<p>No.</p> <p>Satisfies medium conservation value category</p>

Potential Microbat Roost Entry/Exit

Sydney Swans Head Quarters, Moore Park

335741



335741

6247954



Figure 2: Potential microbat roost entry/exit locations

3. Microbat Management

3.1 Approach

The exclusion of microbats from the subject site is required because four of the five cavities within the RHI are microbat habitat and there is a risk of injury and death to microbats from works associated with the proposed adaptive reuse of the RHI. The exclusion methods proposed are leading practice by bat experts.

Given the nature of the roost spaces within the RHI and the difficulties associated with obtaining a clear view into all potential gaps, cracks and crevices it is unlikely that the ecologist will have absolute certainty that the RHI is bat free following a single afternoon / evening of inspections. For this reason, exclusion will be undertaken gradually and in a staged manner. The exclusion will be carried out over multiple nights using one-way valves (plastic cones) placed over each of the entry / exit points after microbats have emerged to forage for the evening. The emergence and return of microbats to each exit point fitted with a one-way valve will be monitored for a two to three-night period. On the final morning (after two to three days) a permanent exclusion device will be installed over all entry / exit points.

Key actions outlined in the MMP involve the following main tasks;

- A project ecologist should be appointed by AAP to ensure the MMP is delivered according to specifications. The project ecologist is an individual with a minimum of three years industry experience, extensive experience in microbat ecology and management as well as extensive experience undertaking microbat field surveys. The project ecologist must also hold an Biodiversity Licence and Animal Care and Ethics Committee approval as well as current Australian Bat Lyssavirus (ABLV) vaccination.
- The exclusion of bats from roosting habitat at the subject site must occur during non-breeding or maternity seasons or overwinter hibernation and extended torpor seasons for microbats. Suitable time periods are late March to end of May at the end of the breeding season when all young should be independent and before food resources drop off over winter and microbats have established winter roosts. An alternative but less ideal option would be to exclude at the end of the winter / hibernation period and prior to the commencement of the breeding season in September, bearing in mind that some microbats may be pregnant in late September.
- Microbat box installation in consultation with the City of Sydney Urban Ecology Coordinator, as well as post-installation monitoring/ reporting on the use of bat boxes.
- Staff environmental inductions which advise contractors of the biodiversity values present onsite, risks to human health and safeguards for dealing with unexpected finds.
- Adaptive management techniques involving close communication between the project ecologist, contractors and client, monitoring and corrective actions. Adaptive management requires flexibility specifically where monitoring determines that microbats are not responding to interventions in an expected manner and additional mitigation actions may be required.

3.2 Compensatory Habitat – Bat Boxes

Bat boxes are to be installed at least one week (but preferably several weeks) prior to commencing the exclusion process and as close as possible to the site to provide alternative habitat for any microbat that is displaced during the exclusion process and for the duration of the proposed works.

This mitigation measure is aimed at providing additional and alternative diurnal roosting capacity, in the immediate local area prior to the planned exclusion works. Provision of bat boxes near the existing roosts ensures that any bats returning to the roosts contained within the RHI later in the morning following the nocturnal exclusion are not caught short and have a safe location in which to roost during the day light hours.

All bat boxes installed must have a unique identifier and the following data recorded for future monitoring and reporting:

- date installed
- unique ID number or code
- zone, easting and northing
- box type
- aspect
- tree species (if relevant)
- tree health (if relevant)
- DBH of tree (if relevant)
- box height above ground.

3.2.1 Bat box design and installation

The use of several box types and entrance sizes are recommended to cater to the needs of different microbat species that may be displaced by proposed works. Several reputable suppliers manufacture bat boxes constructed from wood or Cyplas (a recycled plastic material that has a longer life than wood) and either material would be suitable for this application. It is recommended that a total of four bat boxes be installed on vegetation within the study area or in nearby locations as agreed in consultation with the City of Sydney Urban Ecology Coordinator.

The four bat boxes should comprise a mix of single, double and triple chambered boxes with some boxes having entrance slots of 12 – 15mm wide and others 16-20mm wide at the base of the box. The boxes should be mounted in healthy trees at heights of no less than 4m.

The nest boxes should be installed in a manner that ensures there is a clear flyway to and from the landing pad of the box. Each bat box is to be installed under the canopy of a suitable tree to avoid direct sunlight during the hottest part of the day and more importantly, so that they are hidden from view of the general public. Where practical it is preferable to install boxes so that they are warmed by late afternoon sun.

A short letter style report is to be sent to APP and the City of Sydney urban Ecology Co-ordinator once the bat boxes have been installed outlining the location of each nest box and including photographs of each installed box.

Post-installation monitoring of the four bat boxes is required to be undertaken once during autumn and once during spring, every year for a minimum of two years after installation, and the results to be reported on and delivered to the Sydney Swans and the City of Sydney Urban Ecology Co-ordinator following each monitoring session.

3.3 Exclusion Timing

The proposed exclusion works can only commence once bat boxes have been installed and must be undertaken and completed outside the breeding season (early – mid September to March) or over wintering period (June to August). Exclusion works may therefore only occur from late-March – end of May. Once the exclusion is in place and the cavities in the RHI have been certified to be bat free, works can be undertaken at any time of year.

The exclusion will be planned for a period of mild temperatures (warmer evenings, little or no wind, no rain) with a view to providing ideal foraging conditions for microbats. Microbats can remain in a roost and in torpor for more than two weeks during winter and up to five days during summer (Geiser and Kortner 2010) but are likely to emerge to forage every night or every few nights when the weather conditions are favourable. The staged exclusion will be undertaken over a three-night period when bats are likely to be foraging to allow any bats in torpor to wake naturally and exit the roost before it is excluded to them.

Roost exclusion would not occur during forecast periods of heavy rain (>20 mm in 24 hours according to the Bureau of Meteorology).

Exclusion devices should be installed at least 2 weeks prior to commencement of works to ensure microbats are not continuing to try to return to the cavities within the RHI.

3.4 Roost Exclusion Methodology

The following exclusion process would be applied to the four identified microbat roost entry / exit points of the RHI within the Subject site. Exclusion would aim to remove microbat access to these four cavities identified in the Bat Survey Report (ELA 2020). The objective of controlled roost habitat exclusion is to prevent microbat injury or mortality and avoid impacts to breeding or overwintering colonies of microbats.

3.4.1 Exclusion Process

Roost exclusion would involve the microbat ecologist inspecting the four microbat roost entry / exit points at least one hour prior to sunset to attempt to identify if microbats are present (record species and numbers) and if so, where they are roosting (record locations). Multiple roost entry / exit points can be inspected on a single night provided each roost entry / exit point has a dedicated ecologist conducting an emergence survey on the same evening that one-way valves are being fitted over a roost entry / exit point.

Following the initial inspection an emergence survey including ultrasonic recording must be undertaken outside each of the four entry / exit points. This emergence survey will commence 30 minutes prior to sunset and continue until the ecologist is satisfied that all bats have emerged from the roost, or until there has been a period of sustained inactivity (60-90 minutes). The number of microbats recorded exiting the RHI will be documented along with the general direction of travel and behaviour upon exiting. These observations will be undertaken with the aid of an ultrasonic recording device.

A follow-up inspection of each roost entry / exit point would then be undertaken at the conclusion of the emergence survey to determine whether any microbats remain in the roost.

Exclusion will be undertaken by installing one-way valves (plastic cones) over the roost entry / exit points after the conclusion of the emergence survey. This one-way valve is designed to let microbats out of the roost but not back into the roost. This technique will encourage bats to find roosts elsewhere, limiting the number of bats left without a roost once the permanent exclusion devices are installed over the roost entry / exit. One-way valves will be left in place for 2-3 nights, with emergence surveys undertaken for 1.5 hours at dusk each night to check and record any bats flying out.

Pre-dawn observations by the ecologist should be made at each of the roost entry / exits that have one-way valves installed beginning on the following morning. Pre-dawn observations are to be undertaken over a 1.5 hour period prior to sunrise to note and rescue any microbats roosting in unsafe places, determine whether any microbats have returned and assess the integrity of the exclusion devices. Any microbats roosting in unsafe places will be captured by hand, held in a calico bag (containing no more than five microbats of the same species) in a cool, dark, quiet place for the day until they can be released at the site after dark. Any breaches of the exclusion devices will be noted and marked for repair later that evening.

This dusk and pre-dawn observation process will be repeated on the second and third evening and morning noting any bats that fly out of the roost and rescuing any bats that return to roost in unsafe places.

A permanent exclusion device will be installed over the entrance of each structure on the final morning and secured in such a manner that will allow it to remain in place until and throughout construction works. The ecologist will need to conduct periodic inspections of the exclusion devices (one week after installation then each month prior to works and once on the day prior to roof removal or construction activity at a roost entry / exit point to ensure the exclusion devices continue to function as intended.

If the final early morning inspection (on day 3) records microbats within the a roost entry / exit, the process described above will be repeated using a thermal camera or night vision scope to observe microbats upon emergence to determine where the breach is occurring, and actions taken to rectify the breach after emergence of the microbats. Any evening changes made to the exclusion devices will always be followed by a morning inspection as outlined above.

3.4.2 Exclusion devices

Exclusion devices will comprise heavy duty plastic sheeting fixed around the entry / exit point and shaped into a cone with a small opening at the base. Once the ecologist is certain a roost entry / exit point does not contain microbats, a permanent exclusion device will be installed over all entry / exit points on the final morning of the staged exclusion process.

Hold Point 1- completion of exclusion process

The project ecologist will confirm completion of Hold Point 1 to verify the exclusion process is complete, permanent exclusion devices are in place, the four microbat roost entry / exits are free of microbats and works may commence.

3.4.3 Inspection and maintenance of exclusion devices

Exclusion devices would need to be monitored one week after installation, and then monthly until the commencement of construction works at each potential roost entry / exit point by the project ecologist prior to works to ensure they remain effective in excluding bats, especially following any high rainfall or high wind events. It will be critical that contractors ensure the exclusion devices remain secure and in place until permanent exclusion devices are installed.

Notification is to be sent to the project engineer / site supervisor following completion of the exclusion process confirming that the exclusion is complete and providing photos and descriptions of the exclusion devices that have been installed.

An action log (Table 4) will be kept during the exclusion process and for any monitoring inspections conducted between the exclusion and commencement of works. This log will be submitted to the project engineer / site supervisor upon completion of the project as part of the reporting requirements. The exclusion log will contain the following information:

- action undertaken
- date
- personnel involved
- results / outcomes against performance measures
- effort / time on site
- adaptive / alternative procedures required / recommended.

3.5 Actions during construction

3.5.1 Site induction

All staff and contractors undertaking works at the subject site should be made aware of the environmental sensitivity of the site and the potential presence of threatened microbat species prior to commencing work through undertaking an environmental induction led by the site supervisor. A picture of the four potentially affected threatened microbat species should be placed in the crib room and the location of potential microbat roosts marked on site maps / design drawings displayed on site. Staff should be briefed on what to do in the event of unexpected finds of microbats. Some microbats carry diseases that can be lethal to humans if untreated, and inexperienced / unvaccinated people should never handle bats.



Figure 3: *Miniopterus orianae oceanensis* Large Bent-winged Bats



Figure 4: *Miniopterus australis* Little Bent-winged Bats

3.5.2 Daily Inspection

A daily check of the exclusion devices at the RHI is to be undertaken by the site supervisor prior to commencement of works and records kept of these checks. If the exclusion devices are unsecure the site supervisor must contact onsite environmental staff, the project engineer and the project ecologist immediately so that the breach can be inspected and repaired as soon as possible. No works are to commence at a roost entry / exit point if the exclusion device at the location is not secure. Works at the roost entry / exit point can only recommence once the ecologist provides advice that the site is secure.

If a breach of the exclusion devices has occurred, the exclusion methodology outlined in Section 3.4.1 will be followed by the project ecologist over a single night. The breach will be repaired following conclusion of evening emergence and a dawn inspection of the repaired exclusion device(s) will be undertaken.

A pre-works inspection of each roost entry / exit would be undertaken by the site ecologist prior to works commencing at that location.

Microbats or evidence of their presence can manifest in a range of ways and works staff should be made aware of these signs as part of the site induction process. A set of visual aids for use in the induction process is included as part of this MMP. Evidence of microbat occupancy includes the following:

- Visual (diurnal) observations of singles or clusters of roosting microbats hanging from the obvert (ceiling or roof) or walls or lying within horizontal crevices within the RHI structure.
- Visual (nocturnal) observations of bats flying from or returning to a structure at dusk and dawn, respectively.
- Audible sounds made by roosting bats include a chattering clicking type noise often heard around dusk and dawn or if bats are disturbed in a roost. Any suspicion of unusual noises within the culvert will be investigated further with a handheld ultrasonic call recorder.
- Guano (bat dung / scats) will be present if bats are utilising a roost, even just for a couple of days. Often guano collects immediately under the roost site or sticks to the structure walls under the roost or around the entrances to a roost.

- Staining (urine) may be present where bats frequently access a roost.
- Bat bugs (ectoparasites) or their casings are frequently observed throughout microbat roosts and take the form of tiny tick like or spider like invertebrates.
- Any Welcome Swallow or Fairy Martin nests – mud and earth constructed bird nests - should be investigated as some bat species will utilise disused nests as roost sites.

Works should not commence / all works should stop if roosting bats are found or heard within a work area or bats are observed flying from a roost or around the works site during daylight. Unexpected finds of microbats should be reported immediately to onsite environmental staff, project engineer / site supervisor and the supervising ecologist who will advise the best course of action. In the first instance, photographs should be taken and then sent to the project ecologist to identify the microbats and to determine what actions are required.

4. Contingency Measures

Wild animals can display unpredicted and unexpected behaviours, and this MMP should be considered flexible in its application so that a range of potential outcomes can be provided consistent with NSW Biodiversity Licences and Animal Care and Ethics Committee approvals.

4.1 Adaptive Procedures

The procedures of this plan may be adapted in response to factors such as microbats remaining in cavities within the RHI and not emerging to forage which would have implications for the length of time it takes to exclude microbats from those roost entry / exit points.

The aim is to facilitate the identification of the best course of action for the situation, including time and logistical constraints, as well as the biological constraints posed by the microbats. This would require open communication between the work supervisor, project engineer / site supervisor, onsite environmental staff and the project ecologist.

Microbats are wild animals and do not always behave in the ways we expect or predict. Management plans need to be adaptable enough to respond to situations as they arise and deal with a range of possible outcomes. Modifications to the procedures outlined in this plan may be undertaken provided there has been consultation with the supervising ecologist. The aim of this clause is to allow for the identification of the best course of action to facilitate construction given time and logistical constraints as well as ecological constraints imposed by the affected microbat species.

4.2 Capturing and releasing healthy microbats

If healthy microbats are discovered during works or observed flying from a roost site or around the works site during daylight, stop works immediately and inform the site supervisor, onsite environmental staff, project engineer / site supervisor and supervising ecologist. This is the responsibility of all site personnel. Works that are disruptive to microbats include those which create excessive noise (particularly high-pitched), vibration or light and heat sources, or give off smoke or other potentially noxious gases.

The supervising ecologist may elect to retrieve isolated bats (if possible) that are alive and healthy from the work area, hold them in a calico bag (no more than 5 microbats of the same species to be held in a single bag) during the day in a cool, quiet, dark, well ventilated place and release them at the point of capture once the work area is secured. This should only be undertaken if microbats can be safely released on the night after they were captured. Bats should not be held for more than 12 hours.

If it is not possible to capture and remove the bats, a suitable exclusion zone will be set up by the supervising ecologist and no works will be undertaken within that zone until specifically directed by the supervising ecologist. The exclusion zone will remain in force until the cavity can be confirmed to be bat free.

Some microbats carry diseases that can be lethal to humans if untreated. Bats should not be handled by unvaccinated ((Australian Bat Lyssavirus (ABLV)) and inexperienced persons. This is to minimise any potential for possibility of serious disease transmission. If a non-vaccinated person does come into contact with a microbat, they must seek immediate medical attention. A post- ABLV exposure vaccine is available and should be commenced the same day.

Any evidence of a roosting microbat should be documented, photographed and actions recorded with onsite works staff and directed to the project ecologist for further action. Photos are the first and best course of action to help identify microbats and should be supplied to environmental staff and the project ecologist.

4.3 Injured or dead microbats

If microbats are found injured or dead in a works area, all works in the immediate area should cease and the site supervisor, onsite environmental staff, project engineer / site supervisor and supervising ecologist must be informed. Any evidence of injured or dead microbats should be documented, photographed and actions recorded with onsite works staff and directed to the project ecologist for further action. A suitable exclusion zone will be set up by the supervising ecologist and no works will be undertaken within that zone until specifically directed by the supervising ecologist. The supervising ecologist will inspect the work area and once it has been determined to be bat free, will provide approval for works to recommence.

Injured bats will be removed and taken to a local veterinarian or wildlife carer experienced in the care and handling of microbats by the project ecologist. Options for treatment and future release would be decided and then documented by the supervising ecologist. Costs for treatment would be the responsibility of the contractor. Dead microbats will be collected by the project ecologist (using gloves and a plastic bag) and retained for lodgement with the Australian Museum.

5. Risks

Some of the procedures detailed within the plan pose various risks to human safety. The key risks include:

- contact with microbats
- working at night
- working at heights.

These risks are to be addressed by the project ecologist through preparation of a Safe Work Method Statement (SWMS) that outlines control measures required to eliminate or reduce the risks to acceptable levels.

5.1 Exposure to diseases such as Australian Bat Lyssavirus

Some microbats carry diseases that can be lethal to humans if untreated. Bats should only be handled by vaccinated (ABLV) and suitably experienced persons. This is to minimise any potential for possibility of serious disease transmission. Photos are the first and best course of action to help identify microbats and should be supplied to onsite environmental staff and the project ecologist.

Even if previously vaccinated against ABLV, if anyone is bitten or scratched by a bat, the following actions should be undertaken:

- immediately wash the wound thoroughly with soap and water for at least five minutes - proper cleansing of the wound reduces the risk of infection
- apply an antiseptic with anti-virus action such as povidone-iodine, iodine tincture, aqueous iodine solution or alcohol (ethanol) after washing
- seek medical attention as soon as possible to care for the wound and to assess whether you are at risk of infection.

If at risk of infection, treatment consisting of a combination of rabies immunoglobulin and rabies vaccine may be required. If not vaccinated previously, an injection of rabies immunoglobulin is required as soon as possible and a series of either four or five rabies vaccine injections over one month. If vaccinated previously with a full course of vaccination, two further doses of vaccine will be required. In NSW, Public Health Units will work with general practitioners to assess your risk and where indicated, will arrange for rabies vaccines and immunoglobulin to be delivered to your general practitioner or hospital.

The project ecologist and any other ecologists working on site must be vaccinated against Australian Bat Lyssavirus and wear gloves when handling microbats. The equipment and procedures for dealing with potentially infected persons outlined above must be detailed within the SWMS. Appropriate bat rescue equipment / Personal Protective Equipment (PPE) must be available on site before works commence (cotton bags, gloves, soap and water to wash hands).

Controls to eliminate or reduce the remaining key risks identified above are commonly encountered on construction projects and should be adequately addressed in the Safe Work Method Statement (SWMS) prepared by the project ecologist.

6. Roles and Responsibilities

The construction personnel, project ecologist, project manager and environmental officer form a team that work together to achieve short-term management of microbats at the Subject site through delivery of the MMP.

The project engineer / site supervisor is responsible for:

- notifying the project ecologist if there are any changes to the scope of works or works schedule
- including the actions outlined in the MMP in the Construction Environmental Management Plan (CEMP) or Site Environmental Management Plan (SEMP)
- notifying the project ecologist of the proposed date for commencement of works
- notifying the project ecologist of the proposed date for conclusion of works
- immediately notifying the project ecologist (within the same day) in the event of any unexpected finds of microbats during works (alive and healthy, injured or dead)
- covering the costs associated with rehabilitation and release of any microbat injured during the course of works
- ensuring monitoring of any new microbat habitat is undertaken (if required) and reported on with any recommendations for future improvement provided to the Sydney Swans.

The project ecologist is responsible for:

- providing basic information and pictures of microbats to be included in the environmental induction and to be kept in the crib room and available to all site personnel
- preparing a SWMS and undertaking daily Toolbox Talks for the implementation of the MMP
- procuring bat boxes and exclusion material
- maintaining an action log in relation to activities related to the implementation of the MMP
- monitoring and installing bat boxes and exclusion devices (may require assistance from construction personnel or subcontractors to conduct the exclusion)
- conducting a pre-works inspection of each roost entry / exit point
- providing regular updates to the project manager and site supervisor on the progress of works
- dealing with any unexpected finds of microbats on site, including provision of advice, attendance at site at short notice, rescue, handling, and release of healthy bats, transfer of injured bats to an appropriate wildlife carer and lodgement of dead microbats with the Australian Museum
- reporting on the outcomes of the MMP within one month of completion of works
- undertaking and reporting on monitoring of the bat boxes.

The project ecologist is to provide guidance to the project manager such that the aims of the MMP are achieved and impact to microbats are minimised. Any decision relating to statutory obligations would be discussed or referred to the project manager and environmental officer.

The contractor site supervisor is responsible for:

- conducting environmental inductions for all personnel working on site

- providing the relevant materials on site to deal with the immediate care of bites and scratches from microbats
- conducting daily checks of the exclusion device during the works period
- notifying the project ecologist if the exclusion device is not secure
- notifying the project manager of the proposed date for commencement of works
- notifying the project manager of the dates for conclusion of works
- stopping works on site in the event of any unexpected finds of microbats during works (alive and healthy, injured or dead)
- notifying the project manager of any unexpected finds of microbats during works (alive and healthy, injured or dead)
- maintaining a suitable exclusion zone around any unexpected finds on the advice of the project ecologist.

Construction staff and contractors are responsible for:

- undertaking site inductions including the environmental induction
- assisting the project ecologist with installation of a permanent exclusion device (if required)
- stopping works immediately and notifying the site supervisor, project manager and environmental officer in the event of any unexpected finds of microbats during works (alive and healthy, injured or dead).

7. Reporting and Communication

The project engineer and contractor site supervisor will be kept informed via regular email and phone updates of progress at key milestones throughout the implementation of the MMP by the project ecologist, as listed in table 4. An action log summarising all site works undertaken will be maintained by the project ecologist. The action log will be a record of the actions taken, personnel responsible, timing, results as measured against performance measures and decisions made regarding adaptive measures if required during the installation and monitoring of exclusion devices. The action log will be included in final project report.

A final project report outlining the actions taken in implementing the MMP and the success or otherwise of the MMP in mitigating impacts to microbats including recommendations for improvements to the process that could be employed on future projects will be submitted one month following project completion.

Table 4 below outlines the main actions required in implementing the MMP and this will form the basis of the action log.

Table 4: Action log summary table to be included in the final report

Management Measures	Details	Timing	Performance Indicators	Responsibility
Site inspection	Project inception	Commencement of project	Undertaken at correct timing; inspection report	Project ecologist, site supervisor, project engineer
Environmental induction	Discussion of risks involved and safety procedures	Commencement of project	Staff induction records	Project ecologist, site supervisor, project engineer, contractors and all site personnel
Action log	Commence logging actions	Commencement of project	Action log completed from project commencement	Project ecologist
Procure bat boxes and exclusion materials	Purchase suitable materials	At least two weeks prior to exclusion	Materials obtained at correct timing	Project ecologist
Install bat boxes	Installation of bat boxes	At least one week prior to exclusion	Installed at correct timing	Project ecologist or contractors
Exclusion – Day 1	First diurnal inspection	Late March – May	Correct time of year	Project ecologist
	Emergence survey	After diurnal inspection	Undertaken at correct timing	Project ecologist
	Inspection following emergence survey	After emergence survey	Undertaken at correct timing, record	Project ecologist
	Installation of one-way exclusion devices	After nocturnal inspection	Undertaken at correct timing, record.	Project ecologist
	Dawn inspection	Morning of Day 2	Undertaken at correct timing	Project ecologist
Exclusion – Day 2	Second diurnal inspection	Late March – May	Correct time of year	Project ecologist

Management Measures	Details	Timing	Performance Indicators	Responsibility
	Emergence survey	After diurnal inspection	Undertaken at correct timing	Project ecologist
	Inspection following emergence survey	After emergence survey	Undertaken at correct timing	Project ecologist
	Dawn inspection	Morning of Day 3	Undertaken at correct timing	Project ecologist
Exclusion – Day 3	Third diurnal inspection	Late March – May	Correct time of year	Project ecologist
	Emergence survey	After diurnal inspection	Undertaken at correct timing	Project ecologist
	Inspection following emergence survey	After emergence survey	Undertaken at correct timing	Project ecologist
	Dawn inspection	Morning of Day 4	Undertaken at correct timing	Project ecologist
Permanent exclusion	Install permanent exclusion device	Moring of Day 4	Undertaken at correct timing	Project ecologist
Notification	Email to PM to confirm exclusion complete	Day that exclusion is completed	Undertaken at correct timing, record kept	Project ecologist
Exclusion monitoring	Inspect exclusion device and email results to project manager	One week following install of permanent exclusion device	Exclusion device secure	Project ecologist
Exclusion monitoring	Inspect exclusion device and email results to project manager	Monthly following install of permanent exclusion device and up to commencement of works	Exclusion device secure	Project ecologist
Daily works inspection	Inspect exclusion device and inform project ecologist if action required	Daily during works on Subject site	Exclusion device secure	Site supervisor
Pre-works inspection	Inspect exclusion devices and email results to project manager	Day prior to works at each entry / exit point	Exclusion device secure	Project ecologist
Advice and on-site unexpected finds	Provide advice when requested and remain on-call to attend site during construction	Throughout project as required	Timely responses, attend site as requested	Project ecologist
Reporting	Prepare a report outlining actions undertaken	Within one month following completion of works	Report, at the correct timing	Project ecologist
Bat box monitoring reporting	Conduct checks of bat boxes during autumn and spring	Autumn and spring. Reporting completed	Boxes functional and showing evidence of use. Report delivered	Project ecologist

Management Measures	Details	Timing	Performance Indicators	Responsibility
	each year for two years. Prepare a report outlining monitoring actions and results	following each monitoring event	within a month following box checks	

8. Monitoring

The objectives of monitoring are to:

- ensure no microbats are harmed by the construction works
- identify the need to adjust the exclusion methodology to minimise impacts to microbats
- identify whether the microbat management actions have been implemented and gauge their success
- provide further recommendations for consideration on future projects with similar impacts on threatened microbats.

Monitoring of the exclusion devices would be undertaken by the project ecologist:

- daily during the exclusion process
- one week following the completion of the exclusion process
- once per month until construction occurs
- one day prior to construction at each roost entry / exit point.

8.1 Monitoring methodology

Monitoring during exclusion involves diurnal and nocturnal visual inspections of the roost entry / exit points using binoculars, torches, burrow scopes and cameras, as well as emergence surveys and ultrasonic recording during emergence. Evidence of microbats, the number and species of microbat present, indications of breeding activity, occurrence of any pest species, date and time of inspection and record of the rainfall and weather during inspections will be recorded during each monitoring event. The methodology is outlined in detail in Section 3.4.1.

Details of all monitoring inspections would be recorded in the log of actions and provided to the project manager following each monitoring inspection. The action log (Table 4) would be appended to the final report compiled by the project ecologist and provided to the project manager within one month upon completion of the project.

8.2 Performance measures

The project would be considered successful if there are no microbats injured or harmed as a result of the exclusion process and construction works.

8.3 Monitoring report

The monitoring report would include a brief description of the background to the project, details of the microbat habitat lost and aims and objectives of the monitoring, monitoring methodology, results of monitoring events and recommendations for future improvements to MMPs.

9. Reference List

Churchill, S. (2008). *Australian Bats. Second Edition*. Allen and Unwin Sydney

Eco Logical Australia. (2020). *Sydney Swans Head Quarter Microbat Survey Report*. Prepared for APP on behalf of the Sydney Swans

Geiser, F. and Kortner, G. (2010). Hibernation and daily torpor in Australian mammals. *Australian Zoologist* 35 (2) 204 - 215

Appendix A Potential microbat roost entry/exit location photos

Potential microbat roost entry/exit	Photo
-------------------------------------	-------

1: Near Door 7



2: Near Door 8



Potential microbat roost Photo
entry/exit

3: Eastern turret and facade



4: Inside eastern turret



Appendix E: Biodiversity credit report



BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00018014/BAAS18159/19/00018015	Sydney Swans	30/10/2019
Assessor Name	Report Created	BAM Data version *
	07/11/2019	16
Assessor Number	BAM Case Status	Date Finalised
	Open	To be finalised
Assessment Revision	Assessment Type	
0	Major Projects	

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

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

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAI	Ecosystem credits
------	----------------------	----------------------------------	-----------	----------	---	-----------------------------	---------------	-------------------

Assessment Id	Proposal Name
00018014/BAAS18159/19/00018015	Sydney Swans

Page 1 of 2



BAM Credit Summary Report

Smooth-barked Apple - Red Bloodwood open forest on enriched sandstone slopes around Sydney and the Central Coast							
1	1776_planted_canopy	3.8	0.0	0.25	High Sensitivity to Potential Gain	1.75	0
						Subtotal	0
						Total	0

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAll	Species credits
----------------------	------------------------	-----------------------------	----------	-----------------------------	----------------	-----------------

Assessment Id
00018014/BAAS18159/19/00018015

Proposal Name
Sydney Swans

Page 2 of 2

