Cooks Cove Planning Proposal

Cooks Cove Northern Precinct Flora and Fauna Assessment

Cook Cove Inlet Pty Ltd

21 March 2023

Final

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The preparation of this report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or recommendations contained within the report are based only on the aforementioned circumstances. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Cumberland Ecology.

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Position:	Director
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Date:	21 March, 2023

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Glossary

Term/ Abbreviation	Definition
BLEP 2021	Bayside Local Environmental Plan 2021
CBD	Central Business District
CMA	Catchment Management Authority
Cooks Cove Inlet	The applicant, Cooks Cove Inlet Pty Ltd. (a related entity of John Boyd Properties)
Council	Bayside Council
DA	Development Application
DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water
Development Footprint	The indicative extent of the impact site that requires vegetation to be removed, as shown in **Figure 10**
DPE	NSW Department of Planning and Environment
DPI Fisheries	NSW Department of Primary Industries - Fisheries
DPI Water	NSW Department of Primary Industries - Water
Eastern Precincts SEPP	*State Environmental Planning Policy (Precincts – Eastern Harbour City) 2021*
EEC	Endangered Ecological Community
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EU	Ethos Urban Pty Ltd
FM Act	NSW *Fisheries Management Act 1994*
GFA	Gross Floor Area
GIS	Geographical Information Systems
LGA	Local Government Area
Locality	Area within a 10km radius of the study area
LUIS	Land Use and Infrastructure Strategy
Master Plan	The Urban Design and Landscape Master Plan prepared by Hassell
OEH	NSW Office of Environment and Heritage
RMS	NSW Roads and Maritime Services
SEPP	State Environmental Planning Policy
SMCMA	Sydney Metropolitan Catchment Management Authority Area
SREP 33	Sydney Regional Environmental Plan No. 33 – Cooks Cove
Study area	Cooks Cove site, which encompasses the former Northern and Southern Precincts, as shown in **Figure 1**
Subject site	The Cooks Cove Planning Proposal boundary, which includes the former Northern Precinct of the Cooks Cove site, as shown in **Figure 1**

Term/ Abbreviation	Definition
SWSOOS	Southern and Western Suburbs Ocean Outfall Sewer
TEC	Threatened Ecological Community
TfNSW	Transport for NSW
TSC Act	NSW *Threatened Species Conservation Act 1995*
WM Act	NSW *Water Management Act 2000*

Executive Summary

S1 Introduction

Cumberland Ecology has been commissioned by Cooks Cove Inlet Pty Ltd (Cooks Cove Inlet) to conduct a flora and fauna assessment of the Cooks Cove Planning Proposal boundary (the 'subject site') (formerly known as the Northern Precinct). This report has been prepared to support the public exhibition and assessment of the Cooks Cove Planning Proposal (PP-2022-1748), which was issued a Gateway Determination by the Department of Planning and Environment on 5 August 2022. The proposal seeks to amend *Bayside Local Environmental Plan 2021* (BLEP 2021) to rezone and insert planning controls for certain land known as Cooks Cove within the BLEP 2021.

While the developable area itself is limited to freehold land owned by the Kogarah Golf Club (KGC), the Urban Design and Landscape Master Plan prepared by Hassell also considers some periphery adjacent land to demonstrate how the site could integrate with future surrounding uses (such as the open space and recreation area to be delivered by Bayside Council and TfNSW).

The former Cooks Cove Southern Precinct proposal, which included various public open space enhancements and the golf course relocation, does not form part of this Planning Proposal or the Master Plan.

This Flora and Fauna Assessment is a revised version of the previously submitted report, dated October 2021 (Cumberland Ecology 2021), which has been updated in response to amendments to layout plans following the gateway determination.

The purpose of this updated Flora and Fauna Assessment is to describe the ecological values of the subject site (Planning Proposal boundary) and to assess the impacts the proposed rezoning and subsequent future development may have on flora and fauna, particularly threatened species, populations and communities listed under the New South Wales (NSW) *Biodiversity Conservation Act 2016* (BC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

S2 Background

S2.1 Site Description

The Cooks Cove Planning Proposal is in the suburb of Arncliffe within the Bayside Council Local Government Area (LGA). The broader Cooks Cove site (the 'study area') is located to the west of the Cooks River and Sydney Kingsford Smith Airport, approximately 10km south of the Sydney Central Business District (CBD), 6km west of Port Botany and 1.5km north-east of the Rockdale local town centre. The M5 motorway dissects the broader site into two distinct precincts, formerly referred to as the Northern Precinct and Southern Precinct. The Planning Proposal and this assessment are only focused on what is formerly known as the Northern Precinct.

The Cooks Cove Planning Proposal boundary (the 'subject site') is located to the north of the M5 Motorway and Southern and Western Suburbs Ocean Outfall Sewer (SWSOOS) and is generally bound by the Cooks River to the east and Marsh Street to the north and west. The subject site is approximately 36.3 ha and is owned and managed by several landowners, both public and private, including Kogarah Golf Club, which is in the process of being transferred to Cooks Cove Inlet.

During 2016, the existing 18-hole championship golf course was progressively converted to a 15-hole operation due to the resumption of land for the widening of Marsh Street (March 2016) and the establishment of the temporary construction compound for the WestConnex New M5 (now M8) tunnelling works (June 2016), which was completed and opened in June 2020. The temporary WestConnex facility occupies approximately 7.5 ha of the subject site and is expected to remain in its current arrangement until 2025, as it will now support construction of Stage 1 of the M6 Motorway.

Land in the southern portion of the subject site contains the existing RTA Frog Ponds, located in the south-west corner of the site, adjacent Marsh Street and SWSOOS. The two fenced areas contain ponds, constructed by the RTA as part of the M5 Motorway construction in 2002, as compensatory habitat for the Green and Golden Bell Frog.

S2.2 Assessment History

Considerations for the redevelopment of the Cooks Cove site have had a long history dating back to the late 1990s when a master planning process was commenced, which resulted in the gazettal of the *Sydney Regional Environmental Plan No. 33 – Cooks Cove* (SREP 33) in 2004 (now Chapter 6, *State Environmental Planning Policy (Precincts – Eastern Harbour City) 2021*).

In 2006, a Stage 1 Development Application (DA) for the redevelopment of the whole study area was approved by Rockdale Council (now known as Bayside Council). The DA approved the partial relocation of the golf course, the construction of a business park and associated public domain and environmental management works.

Detailed design DAs for the golf course, public domain upgrades, the new clubhouse and the upgrade of the market gardens were later prepared but never approved before the project was placed into administration in 2009.

Since this time, a new concept for the Cooks Cove site has been developed, which is focused on the former Northern Precinct only (the subject site). The concept involves the relocation of the Kogarah Golf Club to a new location offsite to enable rezoning of the development zone subject site for SP4 Enterprise, RE1 public recreation zoned open space and SP2 zoned infrastructure lands. SREP 33 has been repealed and consolidated into *State Environmental Planning Policy (Precincts – Eastern Harbour City) 2021* (Eastern Precincts SEPP) as of 1 March 2022. However, the SEPP consolidation is administrative and no policy changes have been made i.e. the SEPP consolidation does not change the legal effect of the existing SEPPs/SREPs, with section 30A of the *Interpretation Act 1987* applying to the transferred provisions. As the former SREP 33 – Cooks Cove applied to the subject site, the aims of the former SREP 33 continue to apply to the subject site.

S3 The Proposal

The Cooks Cove Planning Proposal aims to facilitate the long-planned transformation of 36.2 ha of underutilised and strategically important land at Arncliffe, located to the north of the M5 Motorway and adjacent the western foreshore of the Cooks River. The project seeks a renewed focus on delivering a

contemporary logistics and warehousing precinct within a well-connected location, surrounded by enhanced open space provisions.

S4 Methodology

S4.1 Literature Review and Database Analysis

A review of ecological literature relevant to the subject site was undertaken as part of this ecological assessment, to evaluate the flora and fauna values associated with the subject site. Key documents reviewed for this assessment include mapping and flora and fauna reports prepared by the former NSW Office of Environment and Heritage (OEH), the Rockdale Biodiversity Strategy (Rockdale City Council 2014) as well as ecological assessments for the WestConnex New M5 project (Eco Logical Australia 2015a, b), now known as the M8 Motorway and ecological assessments for Stage 1 of the M6 Motorway.

Updated database analysis was conducted for the locality of the subject site using the Environment and Heritage Group (EHG) Atlas of NSW Wildlife Database (EHG 2022) and the Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool (DCCEEW 2022) The locality is defined as the area within a 10 km radius from the boundary of the subject site.

S4.2 Flora Surveys

Cumberland Ecology conducted initial flora surveys across the subject site in February 2017. Surveys included:

- Vegetation mapping, to verify condition and extent of vegetation communities;
- BioBanking plot and transects, to obtain information on species composition and community structure;
- Random meander surveys to detect additional flora species not recorded during plot sampling; and
- Threatened species searches for threatened flora previously recorded from the locality.

Additional flora surveys were undertaken for this revised Flora and Fauna Assessment on 14 September 2021, to collect updated data using the Biodiversity Assessment Method (BAM) and to verify any changes to the vegetation mapping since the 2017 surveys. No additional surveys were conducted following the gateway determination as the most recent 2021 survey data is within the five (5) year validity period accepted by the EHG.

S4.3 Fauna Surveys

Cumberland Ecology conducted fauna surveys across the subject site from February 2017 to March 2017. Surveys included:

- General habitat assessment noting the abundance of various habitat features as well as an assessment of the likelihood of occurrence of potentially occurring threatened fauna species;
- Spotlighting surveys for amphibians, birds, mammals and reptiles;
- Targeted Green and Golden Bell Frog surveys; including basking surveys and call playback/ spotlighting surveys.
- Diurnal bird surveys, including targeted surveys at census points; and

- Microchiropteran bat surveys, including the use of 'Anabats; and 'Song Meters' for ultrasonic call detection and harp traps.

Additional targeted Green and Golden Bell Frog surveys were undertaken in January and February 2020 across the subject site, which included basking surveys and call playback/ spotlighting surveys.

No additional surveys were conducted following the gateway determination as the most recent 2020 survey data is within the five (5) year validity period accepted by the EHG.

S5 Results

S5.1 Vegetation Communities

The subject site has been highly modified, landscaped, and filled, and no original vegetation remains. The subject site was mostly free of mature wooded vegetation in 1943 besides planted figs surrounding the golf club house. Since 1943 the north-eastern half of the golf course has been removed, assumedly during construction of Sydney Airport and the associated realignment of the lower reaches of the Cooks River, and fairways have been completely redeveloped to incorporate land to the south. Due to the substantial modification of the subject site it is unlikely that any of the existing wooded vegetation is regrowth of the original vegetation communities that occurred in the area.

Five vegetation communities have been identified within the subject site. No naturally occurring native vegetation communities occur within the subject site. The following vegetation communities are considered to be semi-natural having recolonised small low-lying areas.

- Mangroves;
- Saltmarsh (BC Act listed EEC);

These two communities comprise approximately 0.03 ha from a total subject site area of approximately 36 ha.

Planted/artificial vegetation dominates almost 100% of the vegetated areas of the subject site, and includes:

- Planted Native Vegetation;
- Exotic Vegetation;
- Lawns and other Exotic Grassland; and
- Aquatic Vegetation.

S5.2 Flora

One hundred and sixty (160) flora species have been recorded within the subject site. Of these the majority (119) were either exotic or planted species not naturally occurring in the area. Three of these species are listed as State Priority weeds under the *Biosecurity Act 2015*, and four are also listed as a Weed of National Significance (WONS). Two additional species are listed as Regional Priority weeds, whilst 13 species are listed as Other Weeds of Regional Concern in the Greater Sydney Regional Weed Management Plan 2017 – 2022.

No threatened flora species were recorded in the subject site, although several threatened flora species have been recorded from the locality. Considering the highly modified nature of the subject site, no habitat for threatened flora species is present and no threatened flora species are likely to occur.

S5.3 Fauna

S5.3.1 Fauna Habitat

The fauna habitats within the subject site occur within the planted areas of trees and shrubs, lawns, artificial wetlands and water bodies, and the shores of the Cooks River. Key habitat features recorded within the subject site include:

- Hollow-bearing trees suitable as shelter and breeding habitat for a range of hollow-dependent fauna;
- Blossom-producing trees and shrubs suitable as forage for a range of frugivores, nectarivores and insectivores; and
- Artificial water bodies that offer suitable aquatic habitat for fish, reptiles, amphibians and birds.

S5.3.2 Fauna Species

Forty-five (46) vertebrate fauna species were recorded within the subject site through incidental observations and targeted surveys, during the 2017 and 2020 surveys by Cumberland Ecology. The fauna group with the highest number of individual species observed was birds (29), followed by mammals (7), amphibians (5), fish (3) and reptiles (2).

The following threatened species have been recorded within the subject site:

- Green and Golden Bell Frog (*Litoria aurea*);
- Large Bent-wing Bat (Miniopterus schreibersii oceanensis); and
- Grey-headed Flying-fox (*Pteropus poliocephalus*).

Although not recorded from the subject site, the Powerful Owl (*Ninox strenua*) and several migratory birds listed under the EPBC Act have been recorded from the locality and have potential to occur in the subject site due to the presence of suitable habitat.

S5.4 Biodiversity Corridors

The subject site forms part of the Rockdale Wetlands Corridor (Rockdale City Council 2014), which is a biodiversity corridor linking a series of habitats between the Cooks River and Lower Georges Rivers. The series of habitats forming this corridor include estuarine, wetland and bushland habitats, as well as recreational space such as parkland, sports fields and the Kogarah Golf Course. The subject site is mapped as the most northern extent of the Rockdale Wetlands Corridor within the Rockdale Biodiversity Strategy (Rockdale City Council 2014).

S6 Impact Assessment

The total subject site is approximately 36 ha in size. The master plan identifies a development precinct of approximately 15 ha, which for the purposes of this impact assessment represents part of the 'development footprint'. The overall development footprint used in this report includes all areas that would require clearing of vegetation and associated habitat within the subject site, for the purposes of the proposed development. This development footprint includes roads and ancillary infrastructure as well as the development precinct.

S6.1 Direct Impacts

S6.1.1 Vegetation Removal

The largest direct impact of the proposed project is the removal of vegetation and associated habitats within the development footprint. Although there are different types of flora and fauna habitat within the subject site such as water bodies and ground litter, the most extensive habitat to be impacted is represented by vegetation. The total indicative area that requires clearing of vegetation, which includes the development parcels, roads and ancillary infrastructure, is approximately 17 ha. Of the 17 ha, less than 0.01 ha comprises semi-natural plant communities. The remaining area of the development footprint is comprised of planted native and exotic plant communities (16.77 ha), cleared land (largely for WestConnex and parking facilities for the Kogarah Golf Club and for the entirety of Lot 31 DP 1231486) and water bodies with fringing aquatic vegetation.

S6.1.2 Loss of Specific Habitat Features

The Project will impact on a range of habitats including a suite of specific habitat features, which include hollow-bearing trees, blossom-producing trees and shrubs and aquatic habitat. Despite the project resulting in the removal of habitat and specific habitat features, extensive areas of land containing similar habitat occurs within the wider Cooks Cove site and surrounds. It is anticipated that the types of flora and fauna species utilising the habitat within the development footprint will continue to persist within retained areas of the subject site and other areas of the Cooks Cove site where suitable habitat is present. The habitats within the subject site are connected with similar habitats within the locality, through the Rockdale Wetlands Corridor (Rockdale City Council 2014).

S6.2 Indirect Impacts

The proposed project will have a range of indirect impacts on the ecological values of remaining vegetation and habitat within the subject site, including edge effects, alteration to wildlife corridors, alteration to hydrological regimes and changes to weed occurrence. Additionally, several construction and operational impacts, such as those relating to dust, noise, light and erosion, will also impact the remaining vegetation and habitat.

S6.3 Impacts to TECs

Only one EEC was considered to be occurring within the subject site; the BC Act listed 'Coastal saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions'. The proposed project will require the removal of less than 0.01 ha of the saltmarsh community.

The areas of the saltmarsh EEC that are proposed to be removed are two very small patches that occur within two open sections of a drainage line which is piped underground for the rest of its extent in the subject site. Due to the small size of these patches, their isolated location within the existing golf course and their artificial nature, the clearing of these areas is not considered to be a significant impact and are considered unlikely to be important for the long-term survival of the local occurrence of this community in the locality.

S6.4 Impacts to Threatened Flora Species

No threatened flora species were recorded as occurring in the subject site during the time of the field survey, despite an intensive survey. Additionally, no threatened flora species are considered to have the potential to occur naturally within the subject site due to the subject site's highly modified nature. Therefore, the proposed

project is unlikely to impact on any threatened flora species listed under the BC Act or EPBC Act, or suitable habitat for threatened species.

S6.5 Impacts to Threatened Fauna Species

Three threatened fauna species have been recorded within the subject site and several other threatened fauna species are considered to have the potential to occur. The proposed project will remove areas of known and potential habitat for these threatened fauna species, however the majority of these species are highly mobile and are considered likely to only be utilising the subject site on occasion as part of a broader foraging range.

The proposed project has the potential to cause direct and indirect impacts to the Green and Golden Bell Frog. Unless mitigated, the activities associated with the proposed project are likely to impact on the Green and Golden Bell Frog within the subject site, resulting in a range of potential direct and indirect impacts. However, although known foraging and dispersal habitat will be removed, the only known breeding locations within the subject site will be retained.

Furthermore, a Green and the Golden Bell Frog Management Plan will apply to the subject site which incorporates active management with the aim to improve the condition of the habitat present and conserve the Arncliffe population. Any potential residual impacts following the implementation of the mitigation measures will be offset under the NSW Biodiversity Offset Scheme and in accordance with the BAM to achieve a no net loss of biodiversity for the project. Therefore, the proposed development is unlikely to have a significant impact on the species.

S7 Avoidance, Mitigation, and Compensatory Measures

S7.1 Avoidance

Cooks Cove Inlet has limited opportunities to limit or avoid impacts to Green and Golden Bell Frog. This is because the land the corporation owns is not land that has been favoured by the species, which has typically been found closely in association with the RTA ponds and (historically) nearby areas of the golf course. The land closest to the RTA ponds is owned by Council, Sydney Water and Transport for New South Wales and as such these entities have the best opportunity for avoidance.

The most ecologically significant area on the subject site is the RTA ponds located in the south-western corner of the subject site, which provides the primary breeding habitat for the threatened Green and Golden Bell Frog within the subject site. In addition to the RTA ponds, based on the distribution of historical records as well as more recent records documented by AMBS Ecology and Heritage as part of their Green and Golden Bell Frog monitoring for NSW Roads and Maritime Services, the south-western portion of the subject site represents the habitat that is mostly utilised by the species for foraging and dispersal within the site.

To conserve the primary Green and Golden Bell Frog habitat, the Planning Proposal has been designed to avoid impacts to this area. The current Master Plan, prepared by Hassell, involves an indicative development reference scheme that is set back significantly further away from the RTA ponds compared to the Minister approved master plan included in the Eastern Precinct SEPP (former SREP 33 – Cooks Cove). As a result, all of the RTA ponds will be retained. Furthermore, the wider south-western portion of the subject site will be retained as passive recreational space and will therefore be utilised much the same as within the current golf course. This are will be subject to works intended to be completed post completion of the M6 Stage 1 by TfNSW contractor

and enhanced through further works to be delivered by Council, which are the subject of conceptual open space planning.

Within this area of the subject site, in accordance with requirements for the approved major projects SSI 6788 New M5 Motorway and SSI 8931 F6 Extension Stage 1, the existing Green and Golden Bell Frog habitat will be subject to maintenance and enhancement. Habitats that have been temporarily removed or altered will also be reinstated to conditions consistent to that prior to construction.

Key avoidance measures undertaken during the development of the master plan specific to the Green and Golden Bell Frog habitat in the subject site include: positioning of the development precinct and road network in the northern and eastern section of the subject site to avoid the species' primary breeding and foraging habitat, and retention and enhancement of a vegetated corridor in along the south-eastern boundary of the site to avoid impacts to the species' linkage to habitat in the southern portion of the study area, being Barton and Riverine Parks.

Additionally, some hollow-bearing trees and trees with potential hollows will be retained within the subject site and incorporated in the development design, to reduce the impacts on native fauna that potentially utilise these trees as habitat.

Scattered planted trees will be retained where possible and incorporated into future open space areas.

S7.2 Mitigation

A range of mitigation measures will be implemented for the proposed project to minimise impacts to biodiversity values, and to provide ongoing management of native fauna species and retained and replanted vegetation, and to guide the overall management of the open space corridors and other landscape elements.

It should be noted commitment to implement the mitigation measures outlined below are mainly limited to the development precinct, which represents the land owned by Cooks Cove Inlet. However, as part of this assessment it is recommended that the proposed mitigation measures are also adopted for all land outside of the development precinct within the subject site.

It is also recognised that the detailed design for mitigation measures involving habitat creation and plantings along the Cooks River foreshore will be subject to consultation with Sydney Airport, as National Airport Safety Framework Guideline C: Managing the Risk of Wildlife Strikes in the Vicinity of Airports is not supportive of land uses in proximity to the airport that increase the probability of bird strike.

The following mitigation measures will be implemented to minimise any adverse effects of the proposed project on biodiversity:

Environmental Management Plans, which provide for the long term and ongoing management (and monitoring) of sensitive habitats and ensure biodiversity values are maintained:

- *Green and Golden Bell Frog Management Plan*; which complements the New M5 Green and Golden Bell Frog Management Plan prepared by Eco Logical Australia on behalf of RMS. Outlines management measures to ensure the Arncliffe population at Cooks Cove is maintained, including improvements to habitat and connectivity for the species.

Vegetation Clearance and Fauna Management Protocols; to limit the impact of construction:

- Delineation of clearing areas, to avoid unnecessary removal or damage to retained vegetation;

- Installation of frog-proof fencing around the development precinct to prevent mortality of Green and Golden Bell Frogs
- Undertaking pre-clearance and clearance surveys, to avoid harm to fauna during demolition, earthworks and construction; and
- Pre-construction clearance frog surveys prior to each stage of the construction process, to remove all Green and Golden Bell Frogs from the construction area; and

Weed Control Measures; to minimise the spread of weeds throughout the site and to areas outside of the site:

- Identification of all weeds present in the construction area prior to construction; and
- Establishment and implementation of a wash-down station, where all construction vehicles entering and leaving the site will be required to be washed down to prevent weed seeds entering or leaving the site.

Nest Box Installation; to minimise the impact on native fauna from removal of hollow-bearing trees:

- Installation of nest boxes in areas of retained tall vegetation; and
- Preparation of a Nest Box Management Plan in the detailed design stage of the project, which will include relevant management and monitoring objectives.

Plantings along Cooks River foreshore; to improve the ecological significance and minimise the impact to the river:

- Establishment of a vegetated riparian buffer along the foreshore, comprised of native woodland plantings and mangroves; and
- Careful selection of species for the plantings, to ensure provision of suitable habitat for local native fauna.

Habitat Creation; to minimise potential impacts on aquatic habitat and to create suitable wetland habitat:

- Creation of semi-aquatic plantings and wetland habitat, including saltmarsh and reedlands, along the southern foreshore of the Cooks River and within parts of Pemulwuy Park South;
- Contribution to embellishment of the Green and Golden Bell Frog habitat within the open space land in the south-western portion of the subject to complement the measures that will be implemented under the conditions for the approved major projects SSI 6788 New M5 Motorway and SSI 8931 F6 Extension Stage 1;
- Include provisions in the detailed design of open space areas within the development precinct to facilitate movement of fauna, including Green and Golden Bell Frogs where suitable, to complement measures implemented within the south-western portion of the subject site; and
- Establishment of mangrove areas along the Cooks River foreshore, to provide sheltered areas for fish and molluscs.

Landscape Management Plan; to ensure landscaped areas provide habitat for local native fauna:

- Plantings of street trees and garden plantings to establish linkages and address biodiversity corridor gaps; and

- Careful selection of species for plantings in all open space areas to include suitable feed trees for species such as the Grey-headed Flying-fox and other native fauna.

Other Relevant Measures;

Planning-related mitigation measures include:

- Staged development which will allow fauna to relocate into adjacent vegetation without assistance by using surrounding habitat connectivity to facilitate dispersal.

General construction mitigation measures include:

- Dust management - to minimise the impacts to vegetation and habitat quality;
- Noise management - to minimise impacts to fauna species noting the proximity of Sydney Airport; and
- Erosion and sedimentation controls - to minimise the impact to adjacent vegetation and downstream environments;

General operational mitigation measures include:

- Ongoing erosion and sediment control and stormwater management; and
- Inspections to monitor effectiveness of mitigation measures and provisions for adaption as required.

S7.3 Compensatory Measures

When avoidance and mitigation measures are considered, there may still be residual impacts to the Green and Golden Bell Frog through the loss of some areas of foraging and dispersal habitat for the species. Some of the more recent records documented in the monitoring by AMBS Ecology and Heritage indicate that a limited number of frogs have been found within the most southern and western edges of the development precinct, adjacent to the retained south-western portion of the subject site. The net decrease in potential foraging habitat for the species will be addressed under the NSW Biodiversity Offset Scheme in accordance with the BAM

S7.4 Adequacy of Avoidance, Mitigation and Compensatory Measures

The proposed package of measures will adequately ameliorate the impacts of the proposal on flora and fauna, including threatened species. In accordance with the hierarchy under the BC Act and BAM, the project has implemented reasonable avoidance measures to avoid impacts to the majority of habitat regularly used by the Green and Golden Bell Frogs based on historical and recent records. A suite of mitigation measures will be implemented for the project to ameliorate any impacts remaining following avoidance, including implementation construction mitigation measures, provision and implementation of environmental management plans, and provision of measures that complement requirements associated with the approved major projects SSI 6788 New M5 Motorway and SSI 8931 F6 Extension Stage 1 for the Green and Golden Bell Frog habitat within the south-western portion of the subject site.

Any residual impacts remaining after the implementation of avoidance and mitigation measures will be dealt with under the Biodiversity Offset Scheme and in accordance with the BAM, which includes the purchase and retirement of biodiversity credits.

S8 Conclusion

The redevelopment of the Cooks Cove Planning Proposal boundary will involve the removal of largely planted native/exotic vegetation, dominated by Planted Native Trees and Shrubs, Exotic Vegetation, Exotic Grasslands and Lawns, and Aquatic Vegetation. Planted/artificial vegetation dominates almost 100% of the vegetated areas of the subject site. One EEC, namely Saltmarsh, which is listed under the BC Act will be impacted by the project. The proposal will require the clearing of a small trace of this community (less than 0.01 ha). The project will also result in the removal of known habitat for three threatened fauna species, including the Green and Golden Bell Frog.

In recognition of the potential ecological impacts of the project, avoidance, mitigation and compensatory measures have been proposed. These include avoidance of breeding and foraging habitat for the Green and Golden Bell Frog, implementation of environmental management plans and provision of offsets in under the Biodiversity Offset Scheme and in accordance with the BAM for any residual impacts. The proposed avoidance, mitigation and compensatory measures are likely to sufficiently ameliorate the impacts of the project to the extent that no EECs or threatened species are likely to become extinct because of the project. Moreover, the long-term objective of these measures is to provide for a net benefit to biodiversity within the Cooks Cove site, through the provision of measures that complement requirements associated with the approved major projects for within the south-western portion of the subject site, and other open space areas within the development precinct, to enhance and embellish the Green and Golden Bell Frog habitat to support the long-term survival of the Arncliffe population.

1. Introduction

1.1. Introduction

This report has been prepared by Cumberland Ecology, on behalf of Cooks Cove Inlet Pty Ltd, to support the public exhibition and assessment of the Cooks Cove Planning Proposal (PP-2022-1748), which was issued a Gateway Determination by the Department of Planning and Environment on 5 August 2022. The proposal seeks to amend *Bayside Local Environmental Plan 2021* (BLEP 2021) to rezone and insert planning controls for certain land known as Cooks Cove within the BLEP 2021.

The Cooks Cove Planning Proposal aims to facilitate the long-planned transformation of 36.2ha of underutilised and strategically important land at Arncliffe, located to the north of the M5 Motorway and adjacent the western foreshore of the Cooks River. The project seeks a renewed focus on delivering a contemporary logistics and warehousing precinct within a well-connected location, surrounded by enhanced open space provisions. The site forms part of the broader Bayside West 2036 Precincts and generally comprises the footprint of the former Kogarah Golf Club, now in part occupied by a temporary M6 Stage 1 construction compound.

While the developable area itself is limited to freehold land owned by Kogarah Golf Club (KGC), the Urban Design and Landscape Master Plan, prepared by Hassell, also considers some periphery adjacent land to demonstrate how the site could integrate with future surrounding uses (such as the open space and recreation area to be delivered by Council and TfNSW). The former Cooks Cove Southern Precinct proposal, which included various public open space enhancements and the golf course relocation, does not form part of this Planning Proposal.

This Flora and Fauna Assessment is a revised version of the previously submitted report, dated October 2021 (Cumberland Ecology 2021) which has been updated in response to amendments to layout plans following the gateway determination. This report applies to the Cooks Cove Planning Proposal boundary (formerly known as the Northern Precinct) only and addresses ecology.

1.2. Purpose

Cumberland Ecology Pty Ltd (Cumberland Ecology) has been commissioned by Cooks Cove Inlet to update the prior flora and fauna assessment of the Planning Proposal boundary (hereafter referred to as the 'subject site') (**Figure 1**), following updates to layout plans in response to the Gateway determination.

The purpose of this report is to describe the ecological values of the subject site and to assess the impacts of the proposed rezoning and subsequent future development may have on flora and fauna, particularly threatened species, populations and communities listed under the New South Wales (NSW) *Biodiversity Conservation Act 2016* (BC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This ecological assessment will form part of the information and assessment package to support the public exhibition and assessment of the Cooks Cove Planning Proposal (PP-2022-1748).

Specifically, the objectives of this ecological assessment are to:

- Describe the existing flora and fauna of the subject site to provide a baseline for impact assessment;
- Describe and map vegetation communities of the subject site, identifying threatened communities listed under the BC Act and/or the EPBC Act;

- Identify and map the location of threatened flora and fauna species or their habitats (if present);
- Assess the likelihood that threatened flora and fauna species could occur in the subject site;
- Describe the types and extent of potential ecological impacts that could arise from the proposed project; and
- Prescribe appropriate avoidance, mitigation or compensatory measures to manage impacts on threatened species and areas of high conservation value.

1.3. Background

1.3.1. Site Description

1.3.1.1. Cooks Cove

The Cooks Cove Planning Proposal is located in the suburb of Arncliffe within the Bayside Council Local Government Area (LGA). The site is located to the west of the Cooks River, approximately 10km south of the Sydney Central Business District (CBD) (**Figure 1**) The site enjoys adjacency to key trade-related infrastructure being immediately west of Sydney Kingsford Smith International Airport and approx 6km west of Port Botany.

Cooks Cove is strategically located within close proximity to a number of railway stations including Banksia, Arncliffe, Wolli Creek and the International Airport Terminal, which vary in distance from the site between 700m and 1.1km. The M5 Motorway, providing regional connectivity to the Sydney Metropolitan area, runs in an east-west direction immediately to the south of the site. The M8 and M6 Motorways are, and will be, constructed in tunnels approximately 60 metres beneath the adjoining Bayside Council 'Trust' lands. The Sydney Gateway project, presently under construction to the immediate north of Cooks Cove and Sydney Airport, will substantially improve future accessibility to the St Peters interchange and the wider M4/M5 WestConnex network, via toll free connections, as well as the Domestic Airport and Port Botany.

The Cooks Cove Development Zone is located to the north of the Southern and Western Suburbs Ocean Outfall Sewer (SWSOOS) and is generally bound by the Cooks River to the east and Marsh Street to the north and west. The site is approximately 36.2ha and is owned and managed by a number of landowners, both public and private. Surrounding development includes the Sydney Airport International Terminal precinct, Mercure Sydney Airport, an area of low-density dwellings presently transitioning to medium-high density residential flat buildings, recreation and open space facilities and road and airport related infrastructure.

For the purposes of this report, the entire Cooks Cove site (former Northern and Southern Precincts) is included in the study area. The study area is defined as the subject site and any additional areas that are likely to be affected by the proposed project, either directly or indirectly, and is shown in **Figure 1**. The subject site is equivalent to the Cooks Cove Planning Proposal boundary, within the overarching study area.

1.3.1.2. Cooks Cove Planning Proposal boundary/Cooks Cove Development Zone

The Cooks Cove Planning Proposal boundary (the subject site) or Cooks Cove Development Zone is located to the north of the Southern and Western Suburbs Ocean Outfall Sewer (SWSOOS) and is generally bound by the Cooks River to the east and Marsh Street to the north and west. The site is approximately 36.2ha and is owned

and managed by a number of landowners, both public and private. Surrounding development includes the Sydney Airport International Terminal precinct, Mercure Sydney Airport, an area of low-density dwellings presently transitioning to medium-high density residential flat buildings, recreation and open space facilities and road and airport related infrastructure.

The subject site encompasses several land parcels including Lot 31 DP 1231486, Lot 100 DP 1001954, Lot 1 DP 108492, Lot 14 DP 213314, and Lot 1 DP 329283.

1.3.1.3. Kogarah Golf Club

1.3.1.4. Kogarah Golf Club was established in 1928, with the Club occupying the land subject to the Planning Proposal boundary since 1955. At this time, the Cooks River was reconfigured to its current alignment to accommodate the expansion of Sydney Airport. The land presents a highly modified environment, with relatively flat topography, gently moulded fairways and greens, separated by strips of vegetation and man-made water bodies. The golf course clubhouse, car park and maintenance facilities are located in the northern corner of the site, adjacent the Cooks River. Access is provided via Levey Street. The members of Kogarah Golf Club will relocate from the site in May 2024 to new playing facilities.

1.3.1.5. Arncliffe Motorway Operation Complex

The temporary construction compound for the WestConnex M8 and M6 Stage 1 Motorway tunnelling works was originally established in June 2016. The temporary construction facility occupies approximately 7.5ha and is expected to remain until 2025. At this time the facility will reduce to 1.5ha to accommodate the permanent Arncliffe Motorway Operations Complex, located in the western corner of the site, adjacent Marsh Street. The complex will house ventilation and water treatment plant and maintenance equipment for both the M6 and M8 sub-grade motorways.

1.3.1.6. RTA Frog Ponds

The subject site contains the existing RTA Frog Ponds, located in the south-west corner of the site, adjacent to Marsh Street and the SWSOOS (**Figure 1**). The two fenced areas contain ponds, constructed by the RTA as part of the M5 Motorway construction in 2002, as compensatory habitat for the Green and Golden Bell Frog.

1.3.1.7. Easements and Affectations

The Sydney Desalination Plant pipeline runs through the development zone, north-south adjacent the Cooks River. The pipe has a diameter of 1.8m and sits within an easement of 6-9m in width. From south to north the pipeline is constructed in a combination of trench and above ground with mounded cover and then transitions to micro-tunnel and typical depth of circa 11m. The Moomba to Sydney Pipeline, containing ethane gas, follows a similar general alignment north-south adjacent the Cooks River. The pipe has a nominal 225mm diameter, within an easement generally 5m wide and with the pipe located at a depth of 1.2m-2.3m.

1.3.2. Landscape Context of the Study Area and Subject Site

1.3.2.1. Historical and Present Land Use

Predominantly used for waste dumping and market gardening for more than a century (Clouston 2000), the Cooks Cove site has had a varied history from the 1880s to 1950s, with sections having been previously used as a sewage farm, market gardens, recreational space and for infrastructure and military purposes. Other uses

include charcoal burners, farms, racing tracks and agistment waste disposal and more recently, sports and wetland revitalization (Land Systems Pty Ltd 1989, Department of Planning and Environment 2016).

The Cooks Cove site has had significant changes in land form to accommodate the expansion of Sydney Airport and realignment of the Cooks River during the 1960s and 1970s. Portions of the subject site were developed into the original Bonnie Doon golf course in 1928 prior to their relocation and the occupation of the site by the military (Department of Planning and Environment 2016). **Figure 2** shows the subject site in 1943, before the realignment of the Cooks River.

Kogarah Golf Club Limited relocated from their former links at Moorefield race track and re-established the Kogarah Golf course in the present location in 1956, later purchasing the freehold component in 1970, and continue to occupy the subject site (former Northern Precinct). As mentioned in previous sections, works for the "WestConnex" New M5 project commenced in 2016 within a section of the golf course.

The southern section of the study area is currently occupied by playing fields, a golf range, the condemned St George Stadium and various walking and cycle paths and is the subject of a Barton Park upgrade redevelopment by Bayside Council.

1.3.2.2. Topography, Geology and Soils

Historically, the land was a sandy, low lying flood plain that was drained and modified early in the history of Sydney for agriculture. This is demonstrated by aerial photography taken in 1943 (**Figure 2**). Later, during the development of Sydney Airport, the course of the Cooks River was changed, and it was moved to its current alignment where it forms the eastern boundary of the subject site.

The study area is relatively flat (Hassell 2016) and has been highly modified in association with the realignment of the Cooks River, landfill operations, and the creation of the golf course and other recreation facilities. The geology underlying the subject site is described as peat, sandy peat and mud overlaying medium to coarse-grained quarts sandstone, very minor shale and laminate lenses of the Wianamatta Group (Consulting Earth Scientists 2017).

The soils of the subject site currently consist of a thin topsoil layer, overlaying a modified sand profile (Hassell 2016). The Soil Landscapes of the Sydney 1:100 000 Sheet Map (Chapman et al. 2005) indicates that the subject site is underlain by 'disturbed terrain'. The landscape and soil characteristics of this soil landscape are described as terrain being disturbed by human activity, often landscaped and artificially drained, with original vegetation completely cleared and replaced with turf or grassland.

1.3.2.3. Hydrology

The original hydrology of the subject site has been changed by the various historical works that have been undertaken including drainage for agriculture, moving of the Cooks River and construction of the golf course.

The land within the subject site generally drains from Marsh Street towards the Cooks River. There is a flood flow path across the existing golf course in the subject site, from Marsh Street, which operates in severe floods in the Cooks River, when flood waters back up behind the Marsh Street bridge (Hassell 2016).

The southern portion of the broader study area, outside of the subject site, contains several wetlands of varying quality and size, including Landing Lights Wetland, Spring Street Wetland and the Spring Street Drain. Within the southern portion, the Spring Street Drain is the primary flow path. This man-made concrete channel follows the original Spring Street Creek and conveys surface runoff from a 220 ha upstream catchment in the Rockdale area, draining to the east into Muddy Creek near the confluence with Cooks River. The Spring Street Drain also facilitates tidal flushing of the Spring Street and Landing Light wetlands, which is conveyed through pipes. Landing Lights Wetland is also fed by tidal flows and surface runoff from a drainage line from the south that receives tidal flow from an old pipe connecting to Muddy Creek to the east.

A small upstream catchment drains to the Eve Street Wetland, which is located just inside the study area to the south of the subject site. These wetlands are connected to the Cooks River via a 400 m channel which passes under the M5 Motorway and to the river via a piped outlet. This change and pipe system also allow tidal ingress to the Eve Street Wetland.

1.3.3. Assessment History

Considerations for the redevelopment of the Cooks Cove site have had a long history dating back to the late 1990s when a master planning process was commenced, which resulted in the gazettal of the *Sydney Regional Environmental Plan No. 33 – Cooks Cove* (SREP 33) in 2004 (now Chapter 6 *State Environmental Planning Policy (Precincts-Eastern Harbour City) 2021*).

In 2006, a Stage 1 Development Application (DA) for the redevelopment of the whole study area was approved by Rockdale Council (now known as Bayside Council). The DA approved the partial relocation of the golf course, the construction of a business park and associated public domain and environmental management works.

Detailed design DAs for the golf course, public domain upgrades, the new clubhouse and the upgrade of the market gardens were later prepared but never approved before the project was placed into administration in 2009.

Since this time, a new concept for the Cooks Cove site has been developed, which is focused on the land formerly known as Northern Precinct only. The concept involves the relocation of the whole golf course to a new location offsite to enable rezoning of the subject site for B7 Business Park, public open space and infrastructure.

1.4. The Proposal

1.4.1. Cooks Cove Master Plan 2022

The Cooks Cove Master Plan 2022, as prepared by Hassell, represents an optimised and refined reference scheme, to guide best practice design and the preparation of detailed planning controls to achieve an attractive precinct with high amenity. Key features of the Cooks Cove Master Plan are:

- A net development zone of approximately 15 ha with up to 343,250m2 Gross Floor Area (GFA) comprising
    - 290,000m2 of multi-level logistics and warehousing;

- 20,000m2 for hotel and visitor accommodation uses;
- 22,350m2 for commercial office uses;
- 10,900m2 of retail uses;

- Multi-level logistics with building heights generally up to 5 storeys (approx. 48m)
- A retail podium with commercial office and hotel above, up to a total of 12 storeys (approx. 51m)
- Built form of a scale and composition which caters for the generation of approximately 3,300 new jobs
- A surrounding open space precinct including:
  - A highly activated waterfront including the Fig Tree Grove outdoor dining and urban park precinct
  - A contribution to the Bay to Bay Regional cycle link, 'Foreshore Walk', including active and passive recreational uses, together with environmental enhancements
  - Master planned and Council-owned 'Pemulwuy Park' - with an agreed embellishment outcome of passive open space and environmental enhancements to be delivered in stages post construction of the M6 Stage 1 Motorway
- Complementary on and off-site infrastructure to be delivered by way of State and Local Voluntary Planning Agreements.

An extract of the Masterplan layout is provided in **Figure 3.**

1.4.2. Proposed Planning Controls

The Planning Proposal Justification Report, as prepared by Ethos Urban, details the intention to insert new planning provisions covering the Cooks Cove development zone and adjoining lands, through the amendment of the BLEP 2021, accordingly removing this same area from *State Environmental Planning Policy (Precincts-Eastern Harbour City) 2021* (Eastern Precincts SEPP) (formerly SREP – 33).

Specifically, the Planning Proposal will:

- Seek new land use zones within the development zone, including a primary SP4 Enterprise zone across the majority of the Kogarah Golf Course freehold land, RE1 Public Recreation foreshore and passive open space zones and elements of SP2 Infrastructure.
- Impose an overall maximum building height of RL51m with appropriate transitions to respond to aviation controls within the southern section of the site and a maximum height of 24m to the north of Marsh Street to respond to neighbouring developments.
- Limit gross floor area (GFA) to the south of Marsh Street to 340,000m2, with a further 1.25:1 Floor Space Ratio (circa 3,250m2 of GFA) to the north of Marsh Street, to achieve the overall intended logistics, commercial, retail and short-term accommodation land uses.

- Other additional permitted uses and site-specific planning provisions.
- Reclassification of Lot 14 DP213314 and Lot 1 DP108492 (Council owned and the subject of Charitable Trusts), initially from 'community' to 'operational' to ensure appropriate access, improve utility of public open space and to create contiguous boundaries. Following rezoning and subdivision it is subsequently intended that Council reclassify residue RE1 parcels as 'community' by resolution.

1.4.3. Land Uses and Indicative Built Form

A summary of the Master Plan is provided in subsequent sections, while a detailed description is provided in the Urban Design and Landscape Master Plan report, prepared by Hassell.

1.4.3.1. Logistics Precinct

Most of the development zone (Block 3) is envisaged to be developed for multi-level buildings accommodating up to 290,000m^2 of warehousing / just-in-time logistics uses. The buildings will comprise single or multiple warehouse tenancies, ancillary office and staff amenities space, circulation and parking. Spiral ramps provide truck access to the upper levels of the buildings. Access will be via the two new roads in off Marsh Street.

The buildings are likely to operate 24 hours a day, seven days per week. Roof space will be used for plant, parking and/or photovoltaic panels for energy generation. External areas will be used for circulation, storage and loading, parking and water detention and treatment facilities.

Each building will be up to 5 storeys in height. With a typical floor to floor height of 7.6m, the buildings will have an overall height of approximately 46m (inclusive of an allowance for roof structures).

1.4.3.2. Fig Tree Office and Accommodation Precinct Village

Located immediately south of Marsh Street, Block 2 will comprise up to 20,000m^2 GFA for hotel and visitor accommodation, up to 20,000m^2 of commercial office GFA with up to 10,000m^2 GFA of retail uses. The retail podium are capable of accommodating a supermarket, speciality retail and food and beverage offering for hotel guests, workers and visitors to the site.

An outdoor retail plaza will be provided that incorporates the majority of mature Moreton Bay Fig Trees.. Parking will be accommodated within a basement or semi-elevated basement with access from Levey Street and from the new access from Gertrude Street. The commercial office building will be 8 storeys in height. The mixed hotel and retail development will be up to 9 storeys. Overall, the buildings will be up to 48m in height across Lot 2.

1.4.3.3. Levey Street Site

Block 1 is a small area of land that sits north of Marsh Street and is accessed from Levey Street. The site is constrained by the underground Ethane Gas Pipeline and the Desalination Pipeline. The site also contains at grade service points for this infrastructure. Concept development will include two building footprints outside of easement areas each with 1 retail level and 2-3 commercial levels above with a GFA of 3,250m2 and a max height of 24m.

1.4.3.4. Cooks River Foreshore

Adjacent to the Cooks River, running along the eastern boundary of the site, is the Cooks River foreshore precinct. The River Foreshore precinct has a linear form (approximately 1km long and 20m wide) and provides space for a regional level walking and cycling track. The total land area is approximately 2 ha. The foreshore will be embellished and maintained by the proponent subject to a public covenant. Embellishment will comprise landscaping, and general seawall and river bank stabilisation.

1.5. Legislative Requirements

Relevant legislation to the project is briefly described in the following sections:

1.5.1. Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is the overarching planning legislation in NSW. This act provides for the creation of planning instruments that guide land use. The EP&A Act also provides for the consideration of the environmental and biodiversity values, which is addressed in Section 5A (Significant effect on species, populations or ecological communities or their habitats) should a land use change be proposed. This includes threatened species, communities, habitat and processes as listed under the BC Act and *Fisheries Management Act 1994* (FM Act).

1.5.2. Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places – defined in the EPBC Act as Matters of National Environmental Significance (MNES). Under the EPBC Act, any action (which includes a development, project or activity) that is considered likely to have a significant impact on MNES (including nationally listed threatened ecological communities and species, and listed migratory species) must be referred to the Australian Government Minister for the Environment (the Minister). The purpose of the referral is to allow a decision to be made about whether an action requires approval on a Commonwealth level. If an action is declared a "controlled action", then Commonwealth approval is required.

1.5.3. NSW Biodiversity Conservation Act 2016

The BC Act is the key piece of legislation in NSW relating to the protection and management of biodiversity and threatened species. The purpose of the BC Act is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development. The BC Act is supported by a number of regulations, including the *Biodiversity Conservation Regulation 2017* (BC Regulation).

The BC Act requires consideration of whether a development or an activity is likely to significantly affect threatened species. For Part 4 local developments, projects that significantly affect threatened species or communities trigger the Biodiversity Offsets Scheme (BOS). The BOS is intended to simplify biodiversity assessment and improve biodiversity outcomes by creating consistent assessment requirements to measure the likely biodiversity loss of development proposals and gains in biodiversity value achieved at offset sites through active management. The BOS requires an assessment following the Biodiversity Assessment

Methodology (BAM) by an accredited BAM assessor and the preparation of a Biodiversity Development Assessment Report (BDAR).

If the project triggers entry into the BOS, a future Development Application must be accompanied by a BDAR prepared in accordance with the BOS.

1.5.4. Fisheries Management Act 1994

Threatened species legislation in NSW currently consists of both the FM Act, and the BC Act. The FM Act protects threatened fish species and marine vegetation and identifies associated threatening processes. It is administered by the NSW Department of Primary Industries (DPI). The BC Act deals with all other threatened biota and threatened processes in the State and is administered by EHG/DPE.

The FM Act has the objective to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations. In particular, this Act includes measures to conserve fish stocks and key fish habitats, to conserve threatened species, populations and ecological communities of fish and marine vegetation, and to promote ecologically sustainable development, including the conservation of biological diversity.

Under the FM Act, "fish" means marine, estuarine or freshwater fish or other aquatic animal life at any stage of their life history and includes molluscs, crustaceans, echinoderms, beach worms and other polychaetes.

Marine vegetation is considered to be key fish habitat and is protected under the FM Act. The FM Act sets out provisions to protect marine vegetation (which includes mangroves, saltmarshes, seagrass and seaweeds) from 'harm'. Harm under the FM Act means '*gather, cut, pull up, destroy, poison, dig up, remove, injure, prevent light from reaching or otherwise harm the marine vegetation, or any part of it*'.

1.5.5. Water Management Act 2000

The *Water Management Act 2000* (WM Act) is, together with the *Water Act 1912*, the key piece of legislation for the management of water in NSW. The objectives of the WM Act are to provide for the sustainable and integrated management of the water sources of the State, and the Act itself is based on the concept of ecologically sustainable development.

Controlled activities on waterfront land in NSW are regulated by the WM Act, and require a controlled activity approval. Waterfront land is defined as the bed of any river, lake or estuary and includes any land within 40 m of the river banks, lake shore or estuary.

1.5.6. Biosecurity Act 2015

Problematic weeds in NSW are handled under the NSW *Biosecurity Act 2015* (Biosecurity Act). Under the Biosecurity Act all weeds are required to be controlled by all persons under a "General Biosecurity Duty". The General Biosecurity Duty means that all public and private land owners or managers and all other people who deal with weed species (biosecurity matters) must use the most appropriate approach to prevent, eliminate, or minimise the negative impact (biosecurity risk) of those weeds (DPI 2017).

Under the Biosecurity Act some weed species have been prioritised for management by specific regulations and controls under the act. These are known as State Level Priority Weeds. The state has been divided into 11 regions (each covering a number of LGAs) under the Act. Within each region, additional weed species known as Regional Priority Weeds have been prioritised for management. A further set of weeds are identified within the Regional Strategic Weed Management Plans as being "other weeds of regional concern".

All land within the subject site occurs within the Greater Sydney Local Land Services region, and weed management within the region is to be undertaken under the direction of the Greater Sydney Regional Strategic Weed Management Plan (LLS: Greater Sydney 2019). Appendix 1 of the Weed Management Plan outlines the State Priority Weeds, Regional Priority Weeds, and other weeds of regional concern.

1.6. State and Local Government Planning Instruments

1.6.1. State Environmental Planning Policy (Precincts – Eastern Harbour City) 2021

The Eastern Precincts SEPP came into force on 1 March 2022 and consolidates and repeals the provisions of the following SEPPs/SREPs:

- Parts of the State Environmental Planning Policy (State Significant Precincts) 2005;
- Darling Harbour Development Plan No 1;
- Sydney Regional Environmental Plan No 26–City West;
- Sydney Regional Environmental Plan No 16–Walsh Bay;
- Sydney Regional Environmental Plan No 33–Cooks Cove; and
- State Environmental Planning Policy No 47–Moore Park Showground.

The SEPP consolidation is administrative and no policy changes have been made i.e. the SEPP consolidation does not change the legal effect of the existing SEPPs/SREPs, with section 30A of the *Interpretation Act 1987* applying to the transferred provisions.

As the former SREP 33 – Cooks Cove applied to the subject site, the aims of the former SREP 33 continue to apply to the subject site as described below:

- Establish planning principles for the development of land that promote the ecologically sustainable use of the Cooks Cove site;
- Rezone land at Cooks Cove to encourage trade and technology uses, and to attract global-reach business, which strengthen Sydney's international competitiveness;
- Capitalise on the physical proximity of the Cooks Cove site to Sydney International Airport and Port Botany to create trade-focussed development;
- Facilitate master planning strategies that will promote the orderly development of public open space and trade and technology land uses;

- Identify appropriate development form and capacity for the Cooks Cove;
- Provide open space for a range of recreational uses;
- Provide for good public access through the Cooks Cove site and along Cooks River foreshore;
- Enhance the Botany Bay to Homebush Bay regional cycleway and pedestrian/cycle network;
- Protect environmentally significant wetlands and the habitat of the endangered Green and Golden Bell Frog;
- Establish vegetation riparian areas along the Cooks River and Muddy Creek foreshores; and
- Provide vegetation riparian buffers around Marsh Street, Eve Street, Spring Street and Landing Lights wetlands.

1.6.2. Bayside Local Environmental Plan 2021

The Cooks Cove site is located within the Bayside LGA and falls under the *Bayside Local Environmental Plan 2021*.

The particular aims of the BLEP 2021 are:

- To protect and promote the use and development of land for arts and cultural activity, including music and other performance acts;
- To protect, conserve and enhance Aboriginal cultural heritage and the environmental, cultural, scenic, built and landscape heritage of Bayside;
- To provide high quality open space areas and recreational facilities;
- To reduce community risk and improve resilience to, and from, urban and natural hazards;
- To encourage sustainable economic growth and development in Bayside;
- To create a liveable urban place through the application of design excellence in all elements of the built environment and public domain;
- To encourage diversity in housing to meet the needs of, and enhance amenity for, Bayside residents;
- To encourage walking, cycling and use of public transport through appropriate intensification of development densities surrounding transport nodes;
- To encourage development that demonstrates efficient and sustainable use of energy and resources in accordance with ecologically sustainable development principles;
- To enhance and protect the functions and roles of the international trade gateways of Sydney Airport and Port Botany;

- To increase urban tree canopy cover and enable the protection and enhancement of green corridor connections;
- To promote and enhance the amenity of Botany Bay's foreshores and Bayside's waterways.

1.6.3. Bayside West Precincts 2036

The Bayside West Precincts 2036 Plan was released by the DPE in August 2018, and the preceding draft Bayside West Precincts Land Use and Infrastructure Strategy (LUIS), was released by the DPE in November 2016 – this progression of strategic planning provides the local strategic framework to facilitate the urban renewal and guide development within the Bayside West Precincts, including Cooks Cove.

The Plan establishes nine planning principles for Cooks Cove to ensure that future development meets State Government objectives. These principles have been implemented separately as Ministerial 9.1 Directions under the EP&A Act (refer to Section 3.2).

The biodiversity study requirements for the Cooks Cove Precinct under the draft LUIS include:

- Provide an ecological study including assessment of threatened species, populations and endangered ecological communities in accordance with the former Office of Environment and Heritage (OEH) Threatened Species Survey and Assessment Guidelines and any relevant draft or final recovery plans; and
- Outline the proposed development of, and impact on ecological corridors that link flora and fauna on and adjoining the site.

1.6.4. Draft Bayside Development Control Plan 2022

The draft Bayside Development Control Plan 2022 (draft Bayside DCP) was amended in December 2022 following public exhibition, and then re-exhibited until 30 January 2023. The draft Bayside DCP will, together with the BLEP 2021, provide detailed planning and design provisions and guidelines for developments within Bayside LGA. The draft Bayside DCP will set out various requirements such as site amalgamation, building setbacks, and landscape treatments, and will aim to facilitate quality development, protect neighbourhood amenity and maintain environmental quality.

The baseline provisions of the draft Bayside DCP will become applicable to the subject site, with a new chapter inserted for specific new controls relevant to the Cooks Cove site, including for biodiversity.

2. Methodology

2.1. Literature Review

A review of relevant ecological literature was undertaken as part of this ecological assessment to evaluate the flora and fauna values associated with the study area. Key documents reviewed include:

- Rockdale Flora and Fauna Study (Biosphere Environmental Consultants 2000);
- Natural and cultural heritage assessment undertaken for the previous Cooks Cove Master planning (Biosis Research 2001);
- Ecological assessments and pre-clearing surveys undertaken by Cumberland Ecology between 2005-2010, as well as the original Flora and Fauna Assessment for the Northern Precinct prepared in 2017 (Cumberland Ecology 2006, 2008b, a, 2010, 2017);
- Monitoring surveys undertaken by Cumberland Ecology (Cumberland Ecology 2009b, a);
- Rockdale Biodiversity Strategy (Rockdale City Council 2014);
- Ecological assessment undertaken for the recently approved WestConnex New M5 project, now known as the M8 Motorway and ecological assessments for Stage 1 of the M6 Motorway (Eco Logical Australia 2015a, b);
- Vegetation mapping and description for the Sydney Metropolitan Area (OEH 2013, 2016c); and
- Green and Golden Bell Frog Monitoring Reports by AMBS Ecology & Heritage, for the Arncliffe population (AMBS Ecology & Heritage 2020, 2021b, a).

The information collected during the literature review guided the field surveys undertaken for this ecological assessment. Information within the literature reviewed was also utilised in determining the likelihood of threatened species occurring within the subject site and assessing the potential impacts of the proposed project.

2.2. Database Analysis

Database analysis was conducted for the original Flora and Fauna Assessment (Cumberland Ecology 2017) for the locality using the EES Atlas of NSW Wildlife database (EES 2021) and the Commonwealth EPBC Protected Matters Search Tool (DAWE 2021).The Atlas of NSW Wildlife Database search facility was used to generate records of threatened flora and fauna species and populations listed under the BC Act within the locality (10 km search area) of the study area. The Protected Matters Search Tool generated a list of potentially occurring MNES listed under the EPBC Act within the locality (10 km search area) of the study area. The lists generated from these databases were used to assist in designing surveys for threatened species considered to have potential to occur within the subject site. The abundance, distribution and age of records generated within the search area also provided supplementary information for the assessment of the likelihood of occurrence of threatened species within the subject site.

An updated database analysis was conducted for the revised October 2021 report, to capture any new records since the original assessment was undertaken in 2017, and any changes in listing status of threatened species.

A further database analysis was conducted for this report to capture any further records and changes in listing status of threatened species since previous assessments.

2.3. Flora Survey

Cumberland Ecology conducted flora surveys across the subject site in February 2017 for the original Flora and Fauna Assessment (Cumberland Ecology 2017), which included the following components:

- Vegetation mapping, to verify condition and extent of vegetation communities;
- BioBanking plot and transects, to obtain information on species composition and community structure;
- Random meander surveys to detect additional flora species not recorded during plot sampling; and
- Threatened species searches for threatened flora previously recorded from the locality.

The mentioned surveys build on the substantial flora survey dataset that has been collected previously from the study area by Cumberland Ecology and others (see **Section 2.1**).

Flora surveys were conducted in the subject site generally in accordance with standards provided in the DPE (then DEC) Threatened Biodiversity Survey and Assessment Guidelines for Development and Activities (Working Draft) (DEC (NSW) 2004) and the former BioBanking Assessment Methodology (BBAM) (OEH 2014a).

Additional flora surveys were undertaken for this revised Flora and Fauna Assessment on 14 September 2021, to collect updated data using the current Biodiversity Assessment Method (BAM) and to verify any changes to the vegetation mapping since the 2017 surveys. No additional surveys were conducted following the gateway determination as the most recent 2021 survey data is within the five (5) year validity period accepted by the Environment and Heritage Group (EHG).

The flora survey methods are described in detail in subsequent sections.

2.3.1. Vegetation Mapping

Several ecological studies have been undertaken in the study area that have provided some indication of the existing vegetation and other habitats, including those by Biosphere Environmental Consultants (2000), Biosis Research (2001), Cumberland Ecology in 2005 and 2007 (Cumberland Ecology 2006, 2010), and Eco Logical Australia in 2014 and 2015 (Rockdale City Council 2014, Eco Logical Australia 2015a, b).

Prior to this ecological assessment, the most recent detailed vegetation mapping project to encompass the subject site, was undertaken by OEH and published as a report in 2013 (OEH 2013), with updates to the vegetation mapping released in 2016 (OEH 2016c). This was aimed at providing a consistent, fine scale map of all vegetation communities present within the Sydney Metropolitan Catchment Management Authority Area (SMCMA).

The mapping by OEH was still at a subregional level and was not based upon site-specific flora survey data collected from the subject site. For this reason, although it provided a useful assessment, it was not at a site scale. For this reason, Cumberland Ecology conducted vegetation surveys within the subject site in February

2017 to provide more detailed, site-specific vegetation mapping that could be used for impact assessment purposes.

Initially, the vegetation mapping from previous surveys was utilized in combination with the more recent OEH vegetation mapping, to create a preliminary vegetation map and to determine potential vegetation communities likely to occur within the subject site. Subsequently, the vegetation within the subject site was ground-truthed to examine and verify the condition and extent of the different vegetation communities. Where vegetation community boundaries were found to differ from the OEH mapping, records were made of proposed new boundaries using a hand-held Global Positioning System (GPS) and mark-up of aerial photographs.

The detailed mapping prepared by Cumberland Ecology was further refined during vegetation mapping surveys in September 2021, to capture any potential changes to the vegetation since the 2017 field surveys. The vegetation units were also further refined, in line with the BAM.

The resultant information was synthesised using Geographical Information Systems (GIS) to create a spatial database that was used to interpret and interpolate the data to produce a vegetation map of the subject site. Mapping was completed using ArcGIS Version 10.4.1.

2.3.2. BioBanking Plots and Transects

Seven BioBanking plots and transects were surveyed during the 2017 flora survey period, using the field survey methodologies prescribed by the BBAM (OEH 2014a). The locations of BioBanking plots and transects were recorded using a GPS and are shown in **Figure 4**. Plot locations were selected so that sampling was conducted in areas most representative of the varying condition and composition of the vegetation within the subject site.

The following data was collected at each BioBanking plot:

- Native species richness recorded within each stratum of a 20 m x 20 m plot;
- Native over-storey projected foliage cover recorded at 10 points along a 50 m transect;
- Native mid-storey projected foliage cover recorded at 10 points along a 50 m transect;
- Native groundcover projected foliage cover recorded at 10 points along a 50 m transect for three life forms (shrubs, grasses and other);
- Weed species projective foliage cover expressed as a percentage of over-storey, mid-storey and ground cover along a 50 m transect;
- Number of trees with hollows where entrance width is over 5 cm and hollow is at least 1 m above ground within the 20 m x 50 m plot;
- The percentage of regenerating canopy species within the vegetation community; and
- The total length in metres of fallen logs over 10 cm in diameter within the 20 m x 50 m plot.

The floristic data is presented in a combined flora list in **Appendix A**.

2.3.3. BAM Plots

Plot-based floristic surveys in accordance with the BAM were undertaken as part of the additional vegetation mapping surveys in September 2021. A total of three (3) plots were surveyed within the subject site, with a focus on native vegetation. The BAM plots were undertaken for the purpose of assisting in the verification and creation of an updated vegetation map, and were undertaken in the locations of three of the previous BBAM plots, as shown in **Figure 4.** Surveys followed the BAM and included establishment of a 20 m x 50 m plot within which the following data was collected:

- Composition for each growth form group by counting the number of native plant species recorded for each growth form group within a 20 m x 20 m plot;
- Structure of each growth form group as the sum of all the individual projected foliage cover estimates of all native plant species recorded within each growth form group within a 20 m x 20m plot;
- Cover of 'High Threat Exotic' weed species;
- Assessment of function attributes within a 20 m x 50 m plot, including:
    - Count of number of large trees;
    - Tree stem size classes, measured as 'diameter at breast height over bark' (DBH);
    - Regeneration based on the presence of living trees with stems <5 cm DBH;
    - The total length in metres of fallen logs over 10 cm in diameter;
- Assessment of litter cover within five 1 m x 1 m plots evenly spread within the 20 m x 50 m plot; and
- Number of trees with hollows that are visible from the ground within the 20 m x 50 m plot.

All vascular plants recorded or collected were identified using keys and nomenclature provided in *PlantNET* (Botanic Gardens Trust 2021).

2.3.4. Random Meander Surveys and Threatened Species Searches

To provide extra flora data between the BioBanking and BAM survey plots, 'random meander' surveys were undertaken throughout the subject site in conjunction with vegetation mapping surveys to maximise the number of vascular plant species recorded. Additional species not recorded during BioBanking plot sampling were noted during the random meander surveys and included in the total species list for the subject site. The locations of the random meander surveys are shown in **Figure 4**.

Targeted threatened flora surveys were undertaken across the subject site for threatened species considered to have potential to occur based on database records. These surveys were undertaken as part of the 2017 and 2021 vegetation mapping ground-truthing, random meander surveys, and BioBanking and BAM plot surveys, and included targeted searches within suitable habitat.

2.3.5. Survey Effort

Flora survey methods and survey effort for the subject site are summarised in **Table 1** below.

Table 1 Flora survey effort

Survey Method	Dates	Effort
Vegetation community mapping	13/02/2017, 16/02/2017	16 hours for two people
Vegetation community mapping verification	14/09/2021	8 hours for two people
BioBanking plot and transect sampling	13/02/2017, 16/02/2017	7 BioBanking plots and transects
Random meander surveys	13/02/2017, 16/02/2017, 14/09/2021	24 hours for two people
BAM plot sampling	14/09/2021	3 BAM plots
Threatened species searches	13/02/2017, 16/02/2017, 14/09/2021	20 hours for two people (targeted) and additional observations throughout survey period

2.4. Fauna Survey

Several ecological studies have been undertaken in the study area that have provided fauna survey data and information , including Biosphere Environmental Consultants (2000), Biosis Research (2001), Cumberland Ecology in 2005 and 2007 (Cumberland Ecology 2006, 2010), and Eco Logical in 2014 and 2015 (Rockdale City Council 2014, Eco Logical Australia 2015a, b).

To add to the baseline of fauna data, and provide up to date fauna information, Cumberland Ecology conducted fauna surveys for selected species in the subject site between February 2017 and March 2017. Additional targeted fauna surveys for the Green and Golden Bell Frog were also undertaken in January-February 2020. These fauna surveys were conducted, where appropriate, in accordance with the survey guidelines provided in the DPE (then DEC) Threatened Biodiversity Survey and Assessment Guidelines for Development and Activities (Working Draft) (DEC (NSW) 2004) and the Commonwealth DCCEEW (then DEWHA) Survey Guidelines for Australia's threatened frogs (DEWHA 2010). The fauna surveys included a general fauna habitat assessment, trapping, spotlighting, Anabat detection, call playback, bird surveys and amphibian surveys.

The fauna survey methods are described in detail in the following sections. The locations of all fauna survey sites are shown in **Figure 5**.

2.4.1. General Habitat Assessment

A general fauna habitat assessment of the subject site was undertaken on 13 February 2017. The habitat assessment included consideration of important indicators of fauna habitat condition and complexity including the presence of suitable nesting, roosting and foraging habitat features suitable for threatened species and the occurrence of microhabitats such as tree hollows, fallen logs, bush rock and wetland areas such as creeks

and soaks. Structural features considered included the nature and extent of the understorey and ground stratum and extent of canopy. The survey also included an assessment of the presence of habitat features suitable for use by threatened fauna species known from the locality.

The general habitat assessment was used to guide the positioning of targeted fauna survey locations in areas of generally higher habitat value.

An updated fauna habitat assessment was undertaken on 14 September 2021, to verify the surveys undertaken in 2017.

2.4.2. Spotlighting

Spotlight surveys for amphibians, birds, mammals and reptiles were undertaken after dark on 13 February 2017, by two ecologists. Spotlight surveys were conducted using a hand-held spotlight while walking a random meander across the entire subject site (**Figure 5**), for a total of approximately 2 hours.

2.4.3. Microchiropteran Bat Surveys

2.4.3.1. Ultrasonic Detection

Surveys for microchiropteran bats were undertaken over a period of five consecutive nights from 9-13 February 2017 using "Anabat" and "Song Meter" units to record ultrasonic bat calls. A total of four locations were surveyed at locations identified in the habitat assessment as potential fly-ways and/or roost sites for microchiropteran bat species. Locations included existing structures and vegetated areas near water bodies (see **Figure 5**). Anabat units were set to activate before dusk each evening and switch off after dawn. Ultrasonic calls collected from the Anabat units were sent to Greg Ford of 'Balance Environmental' for identification.

2.4.3.2. Trapping

Trapping surveys for microchiropteran bats were undertaken over a period of four nights from 13-15 February and 15-17 March 2017 using harp traps. A total of four locations were surveyed for two consecutive nights each at locations identified in the habitat assessment as potential fly-ways for microchiropteran bat species (see **Figure 5**). Harp traps were deployed each night at dusk and checked and taken down each morning at dawn.

2.4.4. Diurnal Bird Surveys

Visual observation and call identification of diurnal birds was carried out throughout the subject site during the general habitat assessment in February 2017 and the targeted fauna surveys in February and March 2017. Diurnal birds were identified and recorded as they were encountered throughout the subject site during the survey period. Additional surveys were conducted at census points within the subject site. A total of seven census points located near water bodies were surveyed for a period of approximately 20 minutes each from 14-15 February and 16 17 March 2017 (see **Figure 5**).

2.4.5. Amphibian Surveys

Visual observation and call identification of amphibians was carried out throughout the subject site during the general habitat assessment and spotlighting survey in February 2017.

Targeted fauna surveys for the Green and Golden Bell Frog (*Litoria aurea*) were undertaken in February and March 2017, as well as January and February 2020, and included basking surveys and call playback/spotlighting surveys.

2.4.5.1. Basking Surveys

A diurnal survey for basking Green and Golden Bell Frogs was undertaken on 8 March 2017 and 28 January 2020. Areas targeted included water bodies and areas of grassland between water bodies known to be utilised for the Green and Golden Bell Frog for foraging (**Figure 5**).

2.4.5.2. Call Playback/Spotlighting

Call playback/spotlighting surveys were undertaken for the Green and Golden Bell Frog concurrently on 6-7 and 15-16 March 2017, as well as 28-30 January and 2 February 2020. Surveys were conducted after dusk, targeting water bodies and areas of grassland between water bodies known to be utilised for the Green and Golden Bell Frog for foraging. Spotlighting was performed using a hand-held spotlight to search for individuals and call playback was undertaken by playing a recorded Green and Golden Bell Frog call through a megaphone for several minutes then waiting for any individuals to call. This process was repeated several times at each call playback location identified in **Figure 5**.

2.4.6. Incidental Observations

Any incidental vertebrate fauna species that were observed, heard calling or otherwise detected on the basis of tracks or signs were recorded and listed in the total species list for the subject site.

2.4.7. Survey Effort

Fauna survey methods and survey effort for the subject site are summarised in **Table 2** below.

Table 2 Fauna survey effort

Survey Method	Dates	Effort
General Habitat Assessment	13/02/2017	8 person hours
Verification of Habitat Assessment	14/09/2021	8 person hours
Spotlighting	13/02/2017	4 person hours
Microchiropteran Bat - Ultrasonic Detection	9-13/02/2017	4 sites, 20 detector-nights
Microchiropteran Bat - Harp Traps	13-15/02/2017, 15-17/03/2017	4 sites, 8 trap nights
Diurnal Bird Survey	Throughout fauna survey period. Seven census points were also surveyed on 14-15/02/2017, 16-17/03/2017	Seven sites, and additional observations throughout fauna survey period
Amphibian Survey - Basking	8/03/2017	5 person hours
Amphibian Survey - Call Playback/Spotlighting	6-7/3/2017, 15-16/3/2017, 28-30/1/2020, 3/2/2020	30 person hours

Survey Method	Dates	Effort
Incidental Observation	Throughout fauna survey period.	n/a

2.5. Weather Conditions

Weather conditions during the 2017, 2020 and 2021 flora and fauna surveys were generally appropriate for detection of a wide variety of flora and fauna. Rainfall was frequent and the weather was warm and humid. This produced good growth conditions for vegetation, and good foraging weather for frogs, bats and flying fox.

A summary of weather conditions in the vicinity of the subject site (Sydney Airport weather station) during the flora and fauna survey periods is provided in **Table 3**.

Table 3 Weather conditions during surveys (Sydney Airport AMO Station 066037)

Date	Survey Group	Temperature Minimum (°C)	Temperature Maximum (°C)	Rainfall (mm)
9/02/2017	Fauna	21.6	32.2	4.8
10/02/2017	Fauna	23.1	42.9	0.0
11/02/2017	Fauna	23.0	39.0	0.0
12/02/2017	Fauna	23.3	28.4	0.0
13/02/2017	Flora, Fauna	16.9	25.9	1.4
14/02/2017	Fauna	20.1	22.8	0.8
15/02/2017	Fauna	17.7	27.7	40.6
16/02/2017	Flora	20.3	33.1	0.0
6/03/2017	Fauna	19.4	23.6	1.0
7/03/2017	Fauna	17.7	22.2	1.2
8/03/2017	Fauna	17.3	23.9	6.8
15/03/2017	Fauna	19.9	27.1	24.2
16/03/2017	Fauna	21.8	27.3	6.0
17/03/2017	Fauna	20.0	23.2	14.6
28/01/2021	Fauna	23.2	30.3	0.0
29/01/2020	Fauna	23.2	29.3	0.0
30/01/2020	Fauna	20.2	29.3	0.0
3/02/2020	Fauna	22.3	31.4	0.0
14/09/2021	Flora, Fauna	7.2	20.8	20.8

*Weather data obtained during surveys

2.6. Limitations

Adequate flora and fauna data have been collected to assess the impacts of the proposed rezoning.

The subject site is a highly modified inner Sydney locality that has been the subject of a suite of flora and fauna investigations during the past two decades. These investigations were conducted for the original M5 environmental impact assessment, for rezoning under former SREP 33 and assessment of more recently proposed developments, including the previously approved Trade and Technology Zone on the subject site, and the WestConnex project that includes a portion of the subject site.

Consequently, vertebrate fauna and vascular flora of the locality is well known based upon a sizeable database of past records and various published reports. The surveys by Cumberland Ecology in 2017 and 2020-2021, during appropriate seasonal conditions, added to the existing database and helped to provide a clear indication of the likelihood that various species occur, or are likely to occur within the subject site. Generally, the data obtained from literature review, database assessment and current surveys of the subject site furnished an appropriate level of information to support the project assessment.

2.6.1. Flora

The weather conditions at the time of the 2017 and 2021 flora surveys were generally very favourable for plant growth and production of features required for identification of most species. Shrubs, grasses, herbs and creepers were readily identifiable in most instances. However, the species assemblage at any given time is likely to be influenced by seasonality and the current condition of the vegetation.

The flora surveys were intended to capture a "snapshot" of the flora species that are present at the time of survey, and it is not expected that an absolute census of the flora species would have been recorded during surveys. Despite this, given the modified, artificial nature of the subject land, it is considered that sufficient information has been collected to assess issues including conservation significance of the flora, condition and viability of bushland and likely impact on native vegetation.

2.6.2. Fauna

In general, the opportunistic observations and targeted fauna surveys undertaken for fauna provides a good indication of the fauna likely to utilise the subject site. However, it is acknowledged that not all fauna utilising the subject site are likely to have been recorded, therefore, the data produced by the surveys is not an absolute census of all vertebrate fauna species occurring within the subject site. An assessment of the likelihood of occurrence of threatened and migratory fauna species listed for the locality in the database searches was undertaken to supplement the fauna surveys. The combination of these techniques is considered appropriate for assessing the habitat values of the site for threatened fauna within the subject site.

3. Results

This chapter presents the results of the flora and fauna surveys undertaken across the subject site. A number of vegetation communities have been mapped within the subject site, and descriptions of these communities are provided below, including floristic data, conservation status and extent. Additionally, a variety of flora and fauna are known to occur in the locality and a diversity of species, including some threatened species, have been identified as occurring or likely to occur within the subject site and are discussed in this chapter.

3.1. Vegetation Communities

The golf course has been highly modified, landscaped, and filled, and no original vegetation remains. The subject site was mostly free of mature wooded vegetation in 1943 besides planted figs surrounding the golf club house (see **Figure 2**). Since 1943 the eastern half of the golf course has been removed, assumedly during construction of Sydney Airport and the associated realignment of the lower reaches of the Cooks River, and fairways have been completely redeveloped to incorporate land to the south. Due to the substantial modification of the subject site it is unlikely that any of the existing wooded vegetation is regrowth of the original vegetation communities that occurred in the area.

Vegetation mapping conducted by the former OEH has identified all the vegetation currently occurring in the subject site as Urban Exotic/Native (**Figure 6**). This community is described by OEH (2013) as a non-native community.

Table 4 lists the vegetation communities occurring within the subject site, their extent, and their conservation status. A total of five vegetation communities are recognised and mapped in the subject site by Cumberland Ecology (**Figure 7**). No remnant native vegetation occurs, though two vegetation types, mangroves and saltmarsh, are considered to be semi-natural having recolonised small low-lying areas. However, they comprise approximately 0.03 ha from a total site area of approximately 36 ha. Planted and exotic vegetation dominates almost 100% of the vegetated areas of the site. Descriptions are provided below. Plant "communities" are named according to the dominant life form of plants in each community.

Table 4 Details of vegetation communities within the subject site

Vegetation Community	Approximate Total Area (ha)	BC Act Status	EPBC Act Status
Semi-natural Plant Communities			
Mangroves	0.02	Not listed	Not listed
Saltmarsh	0.01	EEC	Not listed
Planted Native and Exotic Plant Communities			
Planted Native Vegetation	6.67	Not listed	Not listed
Exotic Vegetation	0.63	Not listed	Not listed
Lawns and other Exotic Grassland	17.40	Not listed	Not listed
Other			
Water Body with Fringing Aquatic Vegetation	0.58		
Cleared Land	10.96		

Vegetation Community	Approximate Total Area (ha)	BC Act Status	EPBC Act Status
Total	**36.26**		

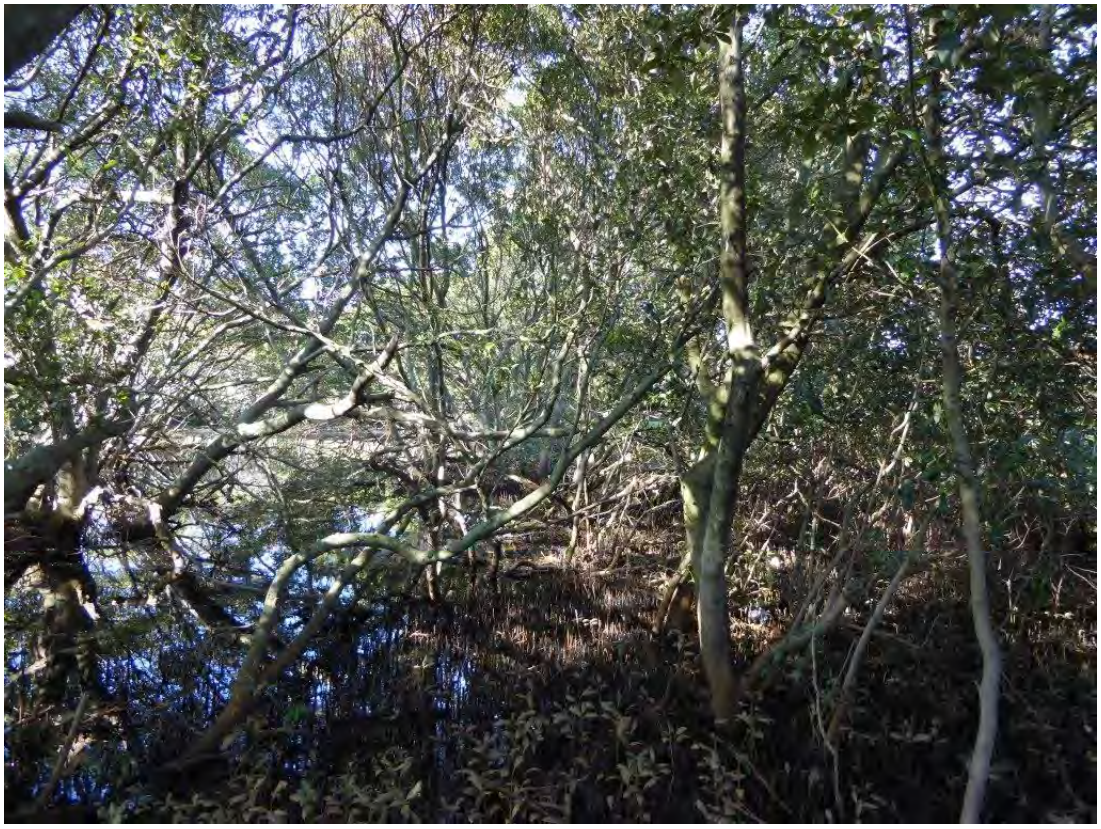
3.1.1. Mangroves

This community occurs in a small water body in the south-east of the subject site. The canopy, sub-canopy, and shrub layer are dominated by *Avicenna marina* subsp. *australasica* (Grey Mangrove) (**Photograph 1**). No other species occur in these layers. The ground layer in shoreline areas that are not permanently inundated have sparse occurrences of the native species *Suaeda australis* (Seablite) *Sarcocornia quinqueflora* subsp. *quinqueflora* (Samphire), and *Juncus kraussii* subsp. *australiensis* (Sea Rush). The exotic species *Atriplex prostrata* (Triangle Orache) and *Juncus acutus* (Sharp Rush) and the introduced native *Cynodon dactylon* (Couch), are also scattered through the layer.

While the status of *Cynodon dactylon* has been changed from Exotic to Native by the Royal Botanic Gardens, the change from exotic to native is still highly debated/contested by botanists as the grass species is cosmopolitan and occurs widely throughout the world. Furthermore, because of its low growth form, this species was and is a commonly used species for landscaping areas, particularly golf courses where low growing grass varieties are extensively grown. Within the subject site *Cynodon dactylon* predominantly occurs within modified fairways of the golf course suggesting that it is an introduced species within the subject site. For this reason, this species is considered to be an exotic (introduced) species within the subject site.

The water body the community occurs in is separated by approximately 70 m from the Cooks River, is not tidally connected, and is considered to be an artificial habitat. The water body did not exist in 1943 (**Figure 2**).

Photograph 1 Grey Mangroves (*Avicennia marina*) within the south of the subject site



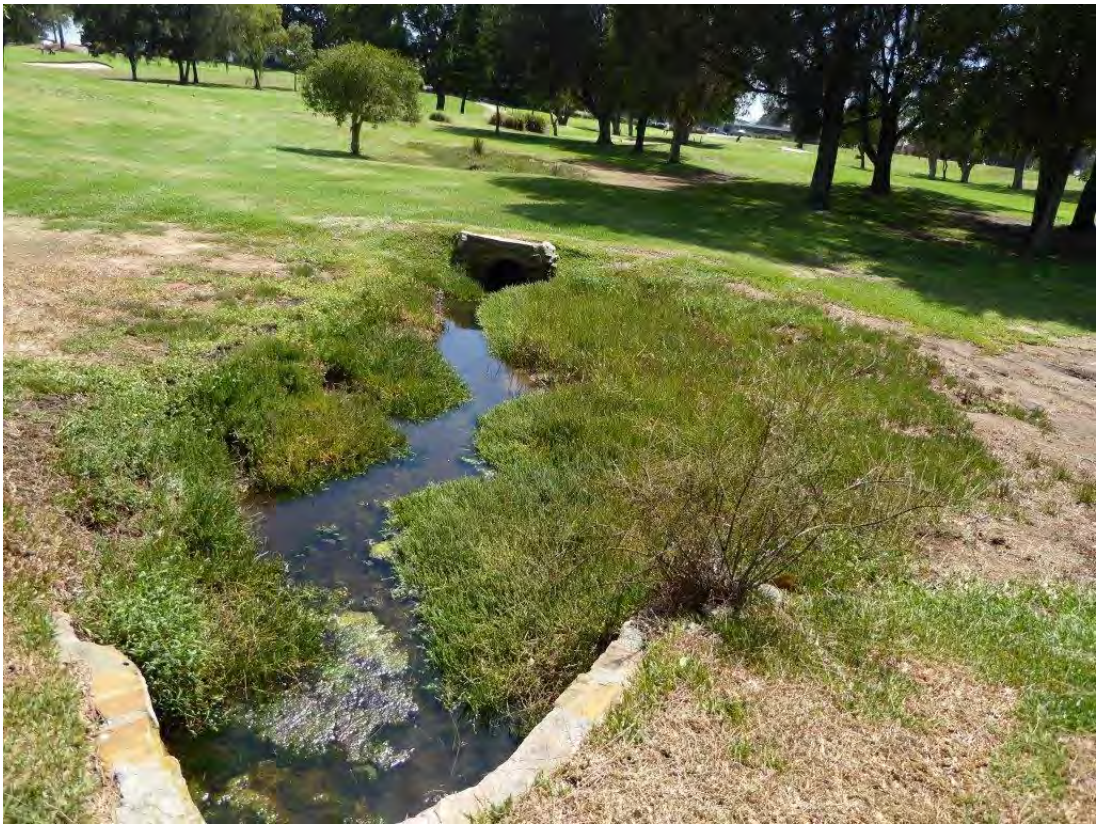
3.1.2. Saltmarsh

Two very small patches of this community occur within two open sections of a drainage line which is piped underground for the rest of its extent in the subject site (**Photograph 2**).

This community in the subject site is dominated by the native *Sarcocornia quinqueflora* (Beaded Samphire). The native species *Bolboschoenus caldwellii* is common, and *Juncus kraussii* and *Triglochin striata* (Streaked Arrowgrass) also occur. The exotic species *Atriplex prostrata* (Triangle Orache) and *Juncus acutus* subsp. *acutus* (Sharp Rush) are present, though in small abundances.

Although the saltmarsh occurrences within the subject site are within an artificial drainage line, the community is considered to meet the final determination description of the EEC 'Coastal saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions' that is listed under the BC Act. However, the Saltmarsh community is not considered to conform to the EPBC Act listed 'Subtropical and Temperate Coastal Saltmarsh', as the total patch size of the community is less than 0.1 ha and does therefore not meet the condition thresholds for the Threatened Ecological Community (TEC).

Photograph 2 Saltmarsh dominated by *Sarcocornia quinqueflora* (Beaded Saltmarsh) in the subject site



3.1.3. Planted Native Vegetation

This community consists of plantings of species that are indigenous to NSW, and classified as "native vegetation" as per the definition under the NSW *Local Land Services Act 2013*, which is utilised in the BAM. This definition of native species includes those species which occurred naturally in NSW prior to European Colonisation.

The Planted Native Vegetation community is scattered throughout the subject site, comprising over half of the wooded vegetation, and is variable in species composition based on location (**Photograph 3 - 6**). Vegetation in this community generally consists of planted trees/small trees and shrubs over exotic grassland, and in native garden beds.

Extensive areas of the subject site consist of groves of trees between fairways that consist of mono-specific plantings and mixed plantings of tree species that may have been indigenous historically to the subject site and are common in the locality. These species include *Melaleuca quinquenervia* (Broad-leaved Paperbark) and *Casuarina glauca* (Swamp Oak). Other planted species that may have been indigenous to the subject site though have been less commonly planted within the site include *Eucalyptus robusta* (Swamp Mahogany), *Eucalyptus botryoides* (Bangalay), and *Eucalyptus saligna* x *botryoides*.

These tree species are characteristic species of two Endangered Ecological Communities (EEC) listed under the BC Act; Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions, and Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East

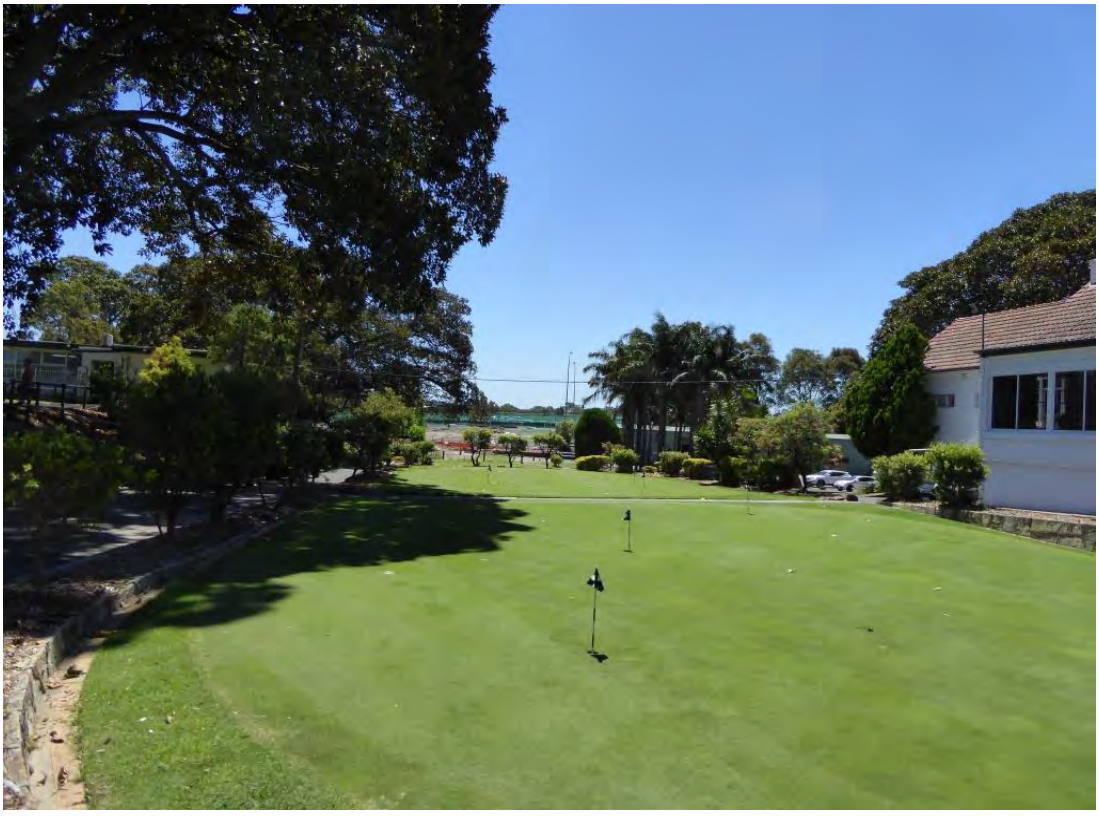
Corner Bioregions. However, due to the complete lack of characteristic understorey and ground layer species associated with these stands of trees, and their planted status, stands of these trees in the subject site are not considered to conform to the description of either EEC. As seen in **Figure 2**, the relevant stands of Planted Native Vegetation were not present in 1943, hence are unlikely to be remnant vegetation.

Other tree species within the community include native species not indigenous to the Botany Bay or Sydney area such as *Eucalyptus nicholii* and *Casuarina cunninghamiana* (River Oak). Locally native species include *Eucalyptus punctata* (Grey Gum), *Corymbia maculata* (Spotted Gum), *Banksia integrifolia* (Coast Banksia), and *Leptospermum laevigatum* (Coastal Tea Tree).

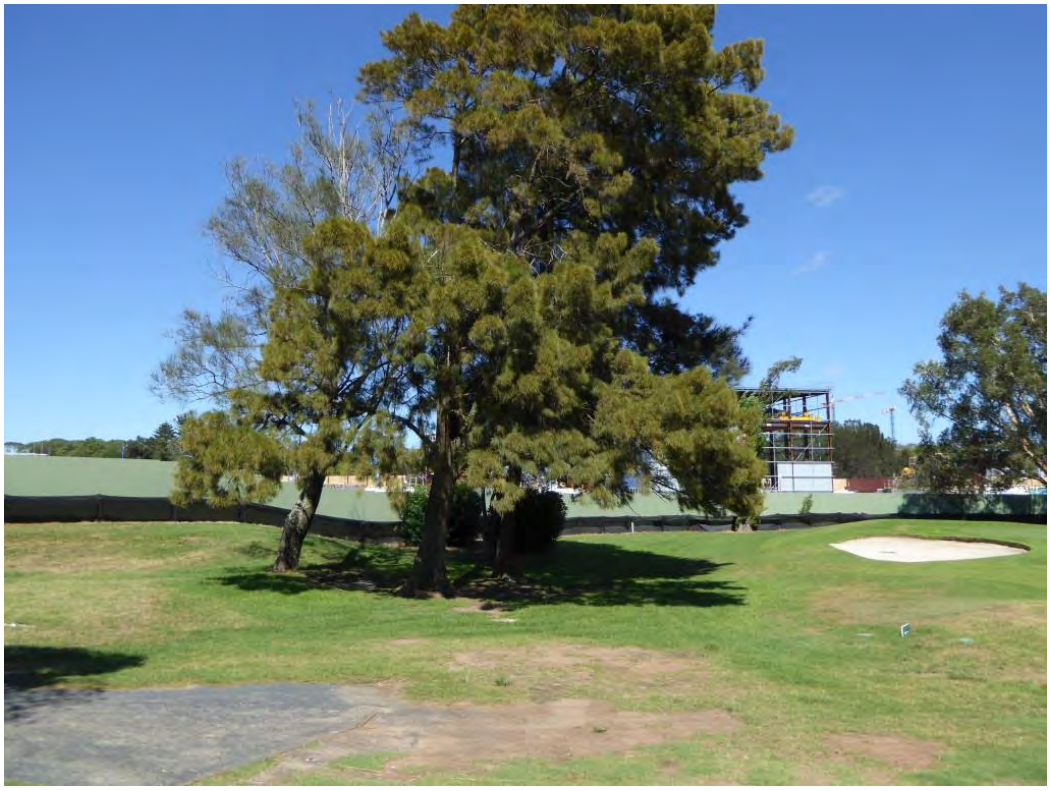
As with trees, native shrubs (or juvenile trees) planted throughout the golf course are a mix of natives that naturally occur within the Sydney Region and the locality, and natives not indigenous to Sydney. Local natives include *Callistemon citriodora* (Crimson Bottlebrush), *Melaleuca armillaris* (Bracelet Honey-Myrtle), *Tristaniopsis laurina* (Water Gum), *Banksia spinulosa* (Hairpin Banksia), and *Cupaniopsis anacardioides* (Tuckeroo). Non-local natives include *Acacia baileyana* (Cootamundra Wattle), *Leptospermum petersonii* (Lemon-scented Tea Tree), and *Melaleuca leucadendra* (Weeping Paperbark).

The ground layer of the community throughout the majority of the site consists of Exotic Grassland as described below. Garden plantings such as in the area surrounding the golf club house include the native *Dianella caerulea* (Blue Flax-lily) and the native cultivar *Lomandra longifolia* "Tanika".

Photograph 3 Planted gardens surrounding club house and practice greens.

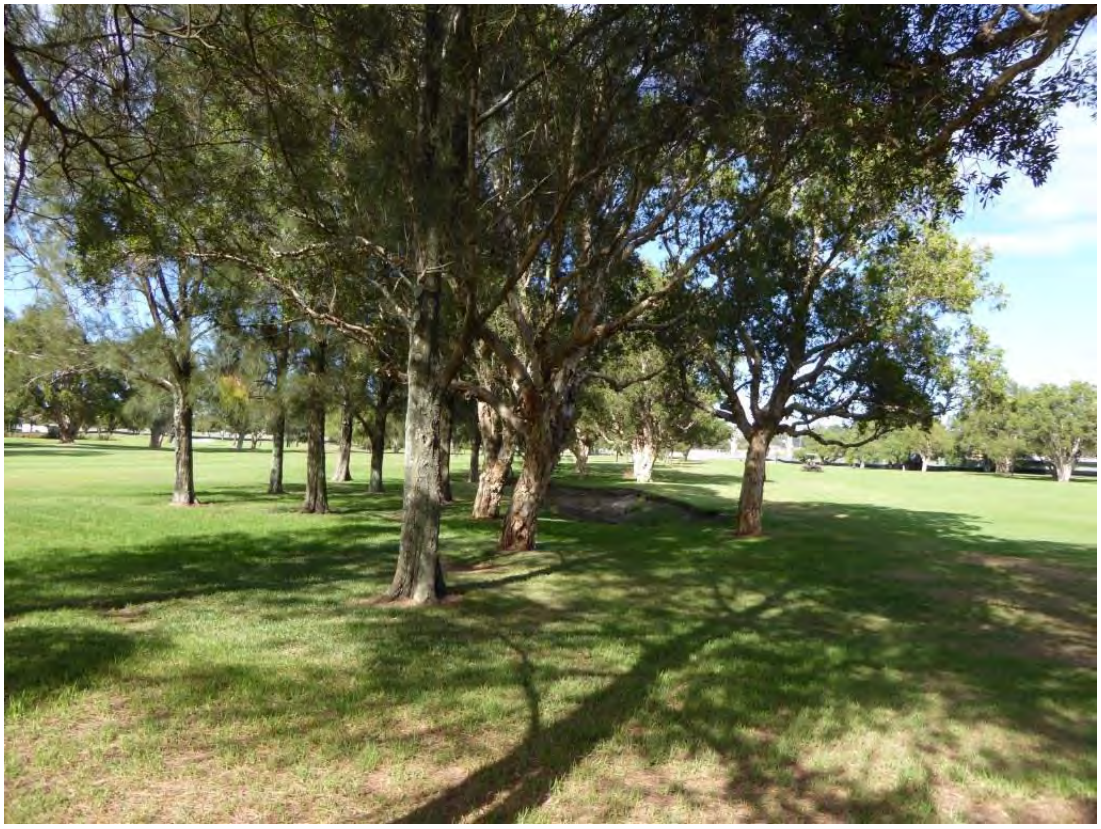


Photograph 4 Casuarina cunninghamiana (River Oak) planting within golf course



Photograph 5 Planted Casuarina glauca (Swamp Oak) grove

Photograph 6 Mixed grove of Melaleuca quinquenervia (Swamp Paperbark) and Casuarina glauca (Swamp Oak).



3.1.4. Exotic Vegetation

Exotic vegetation is defined in this report as species that would not meet the definition of native under the BAM, i.e. species not indigenous to Australia at all, or Australian native species that did not occur naturally in NSW prior to European colonisation. This community includes species that have been planted for landscaping purposes and exotic weed species which have colonised areas of the site, such as along the south-western boundary of the site where there is infestations of *Lantana camara*.

Trees and shrubs indigenous to Australia, but not NSW, include *Eucalyptus cladocalyx* (Sugar Gum), *Lagunaria patersonia* (Norfolk Island Hibiscus), *Ficus microphylla* var. *hillii* (Hill's Weeping Fig), *Agonis flexuosa* (Western Australian Peppermint), and *Corymbia ficifolia* (Albany Red Gum).

Exotic species include *Schinus areira* (Pepper Tree), *Salix babylonica* (Weeping Willow), *Gleditsia triacanthos* (Honey Locust), *Ficus benjamina* (Weeping Fig), and *Metrosideros excelsa* (New Zealand Christmas Tree), *Nandina domestica* (Japanese Sacred Bamboo), *Buxus microphylla* (Japanese Box), and *Pinus radiata* (Radiata Pine).

Some exotic, ornamental, herbaceous species are also present planted in garden beds, such as around the club house and include *Tradescantia pallida* (Purple Queen), *Dietes grandiflora* (Fairy Iris), and *Clivia miniata* (Clivia).

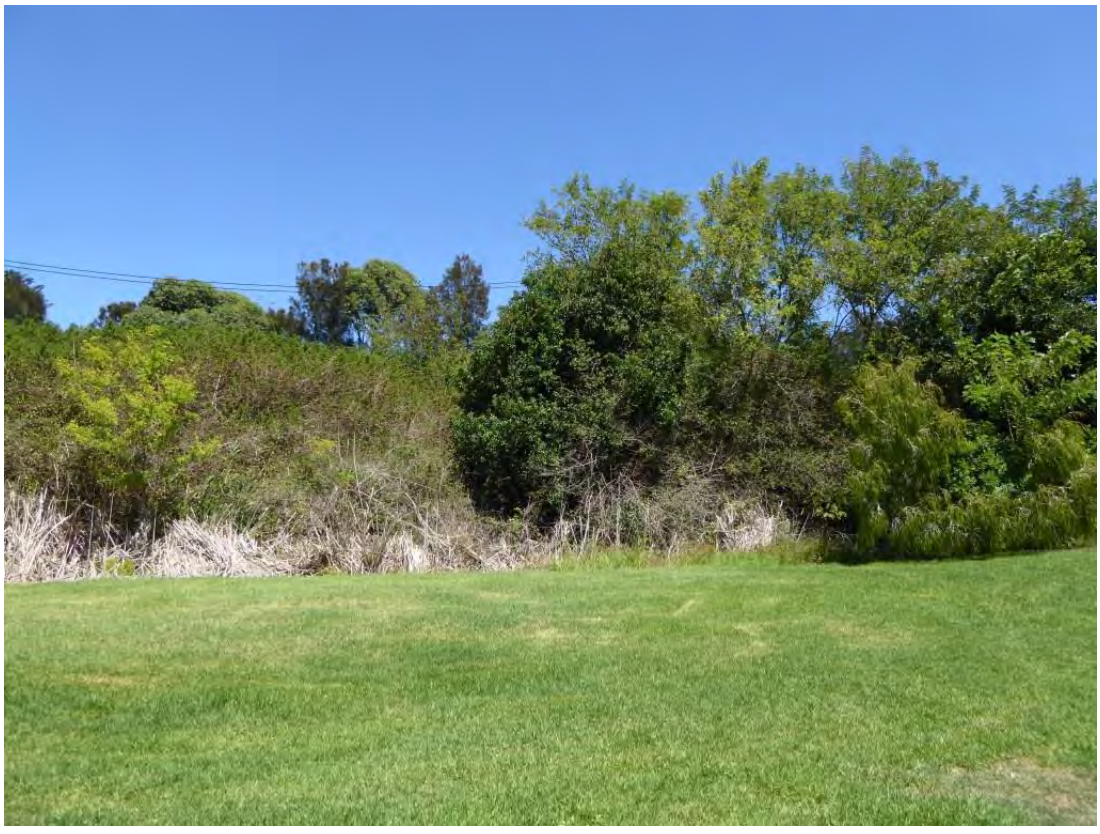
On dry, unmown embankments in the south-western area of the subject site in proximity to the RTA ponds, patches of weed-dominated shrubs and grassland also occur. This occurrence of exotic vegetation community is dominated by exotic species with a few scattered native small trees and shrubs of common non-threatened species (**Photograph 7**).

Tree species within the community consist of the exotic weed species *Ligustrum lucidum* (Broad-leaved Privet), *Ulmus parvifolia* (Chinese Elm), and *Cinnamomum camphora* (Camphor Laurel). Small trees/tall shrubs present include the exotics *Celtis sinensis* (Chinese Celtis), *Morus alba* (White Mulberry), *Salix babylonica* and *Lagunaria patersonia*. The non-endemic natives *Melia azedarach* (White Cedar) and *Acacia saligna* (Golden Wreath Wattle) are present, along with scattered occurrences of *Pittosporum undulatum* (Sweet Pittosporum) and a single occurrence of *Melaleuca quinquenervia* (Broad-leaved Paperbark).

The shrub layer, where present, is dominated by the exotic species *Lantana camara* (Lantana), with *Cestrum parqui* (Green Cestrum) and *Ricinus communis* (Castor Oil Plant) occurring commonly, along with a small number of *Gleditsia triacanthos* (Honey Locust). The native species *Acacia longifolia* subsp. *sophorae* (Coastal Wattle) and *Pittosporum undulatum* have a scattered distribution within the layer of the community.

The ground layer is dominated by a dense covering of exotic forbs and grasses. Common exotic forbs include *Hydrocotyle bonariensis* (Pennywort), *Acetosa sagittata* (Turkey Rhubarb), *Bidens pilosa* (Cobbler's Pegs), and *Conyza sumatrensis* (Tall Fleabane). Exotic grasses include *Cenchrus clandestinus* (Kikuyu), *Paspalum dilatatum, Stenotaphrum secundatum* (Buffalo Grass), and *Melinis repens* (Natal Grass).

Photograph 7 Exotic vegetation in the south-west of the subject site



3.1.5. Lawns and other Exotic Grassland

Mown lawns cover approximately 69% of the vegetated areas of the subject site (**Photograph 8**). The majority of this vegetation is comprised of three exotic lawn grasses, *Stenotaphrum secundatum*, *Cynodon dactylon* (See section 3.1.1 for exotic status), and *Cenchrus clandestinus*.

A number of common exotic grasses are present as weeds throughout the subject site, especially where mowing is absent or less intensive. These include but are not limited to *Ehrharta erecta* (Panic Veldtgrass), *Sporobolus africanus* (Parramatta Grass), and *Eleusine tristachya* (Goose Grass).

Exotic forbs are scattered throughout the community, but tend to be uncommon, likely due to regular close mowing and potentially the use of broadleaf herbicides. Species present include *Paronychia brasiliana* (Chilean Whitlow Wort), *Stellaria media* (Chickweed), *Polycarpon tetraphyllus* (Four-leaf Allseed), and *Sonchus oleraceus* (Milk Thistle)

3.1.6. Aquatic Vegetation

Artificial water bodies such as dams within the golf course and a drainage channel through the centre of the subject site contain fringes of native and exotic aquatic macrophyte species (aquatic and semi-aquatic plants). These areas have not been mapped separately due to their small size and are instead incorporated with the water bodies mapped within the subject site (see **Figure 7**).

Macrophyte species present include tall native rushes, grasses, and sedges such as *Typha orientalis* (Bulrush), *Schoenoplectus validus*, and *Phragmites australis* (Common Reed), which occur in dense patches in some areas. Other species scattered along the central drainage line include the native saltmarsh species *Sarcocornia quinqueflora*, *Bacopa monnieri*, and *Juncus kraussii*. The exotic species *Juncus acutus* and *Atriplex prostrata* are also present.

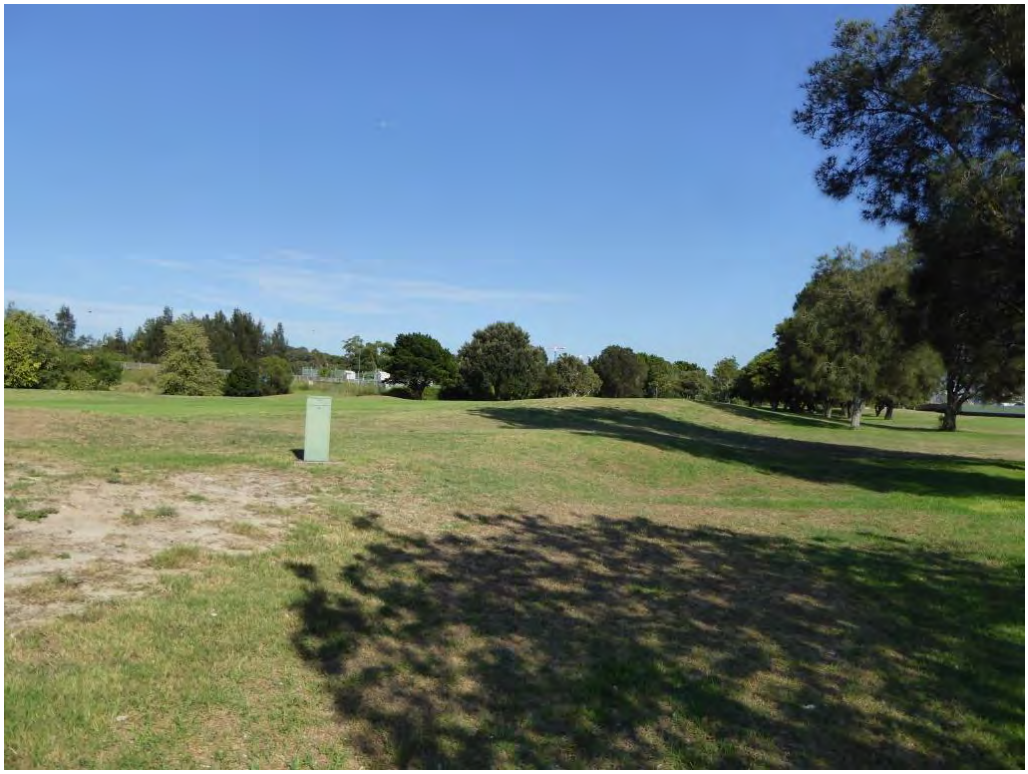
Some of the native aquatic species present in the water bodies of the subject site are characteristic species of two EECs listed under the BC Act; Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions, and Coastal saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions.

The Freshwater wetlands EEC Final Determination notes that "Artificial wetlands created on previously dry land specifically for purposes such as sewerage treatment, stormwater management and farm production, are not regarded as part of this community, although they may provide habitat for threatened species" (NSW Scientific Committee 2011b). Due to the artificial nature of the water bodies within the subject site, aquatic vegetation present is not considered to conform to this EEC.

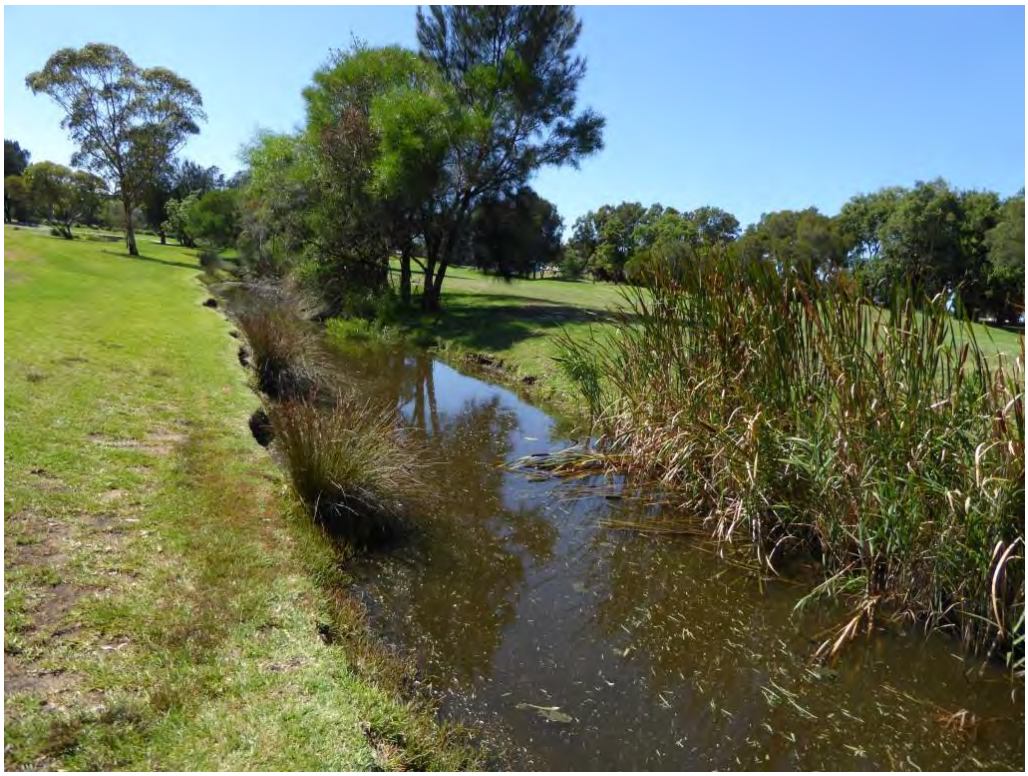
The final determination for Coastal Saltmarsh describes the community as "occurring in the intertidal zone on the shores of estuaries and lagoons" (NSW Scientific Committee 2011a). The saltmarsh species occurrences within the central drainage line are within an artificial water course and are not considered to be consistent with the final determination description of the EEC.

Examples of aquatic vegetation within the subject site are shown in **Photograph 9-10**.

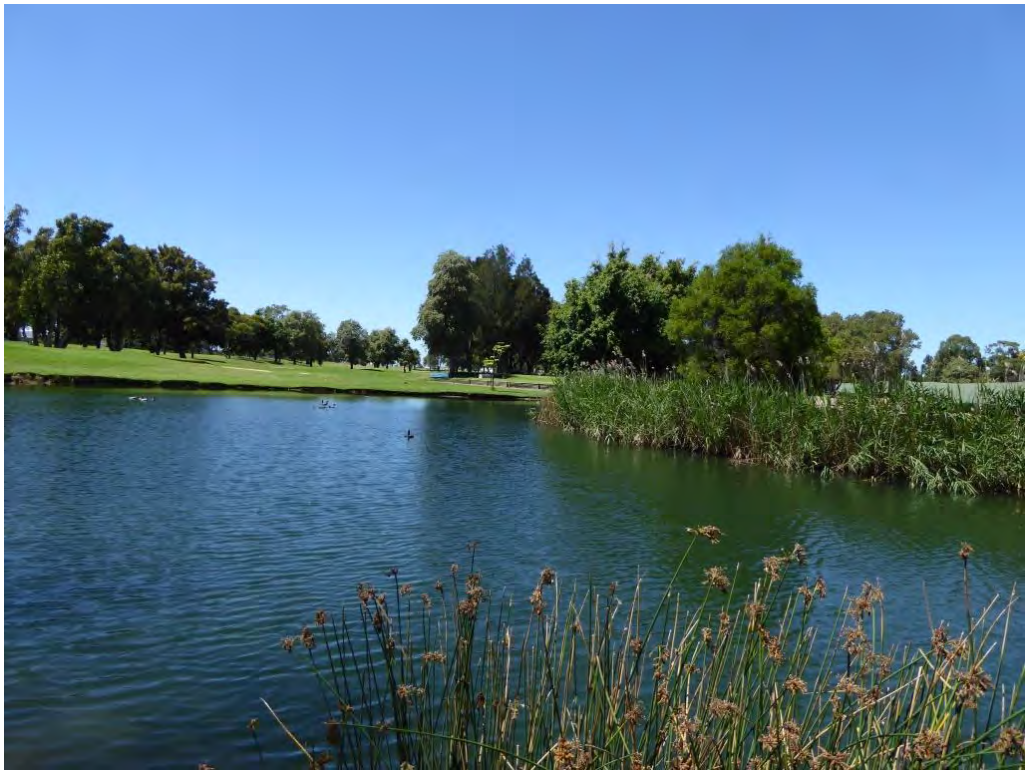
Photograph 8 Lawns in the south of the subject site



Photograph 9 Aquatic vegetation within the central drainage line in the subject site



Photograph 10 Aquatic vegetation within dam in centre of the subject site



3.2. Flora

3.2.1. General Species

One hundred and sixty (160) vascular plant species have been recorded within the subject site. Of these the majority (119) were either exotic or planted species not naturally occurring in the area.

Three State Priority Weeds, which are also Weeds of National Significance (WoNS), were recorded within the subject site. One additional species that is considered a WoNS was recorded, whilst two Regional Priority Weeds also occur. The spread of these types of species must be minimised to the extent possible, and the sale or distribution of these species is prohibited.

Thirteen other weeds occurring within the subject site are listed as Other Weeds of Regional Concern in the Greater Sydney Regional Weed Management Plan 2017 – 2022. These are weeds that may be useful or widely spread as crops or garden plants, but that can become invasive and threaten assets in certain circumstances.

Priority Weeds and Other Weeds of Regional Concern (collectively referred to henceforth in the report as "Priority Weeds") located within the subject site are detailed in **Table 5** below. A list of plant species that were detected on subject site is provided in **Appendix A**.

Table 5 Priority weeds recorded within the subject site

Scientific Name	Common Name	NSW Weed Status	WoNS
Acetosa sagittata	Turkey rhubarb	OWRC	
Asparagus aethiopicus	Ground Asparagus	SP	Yes
Celtis sinensis	Japanese Hackberry	OWRC	
Cenchrus clandestinus	Kikuyu	OWRC	
Cenchrus setaceus	Fountain grass	OWRC	
Cestrum parqui	Green Cestrum	RP	
Cinnamomum camphora	Camphor laurel	OWRC	
Eragrostis curvula	African lovegrass	OWRC	
Gleditsia triacanthos	Honey Locust	OWRC	
Juncus acutus	Spiny rush	OWRC	
Lantana camara	Lantana	SP	Yes
Ligustrum lucidum	Large-leaved Privet	OWRC	
Murraya paniculata	Orange jessamine	OWRC	
Olea europaea subsp. cuspidata	African olive	RP	
Phoenix canariensis	Phoenix palm	OWRC	
Pinus radiata	Radiata pine, Pine wildings	OWRC	
Salix babylonica	Weeping Willow		Yes
Senecio madagascariensis	Fireweed	SP	Yes
Syagrus romanzoffiana	Cocos palm	OWRC	
Ulmus parvifolia	Golden elm	OWRC	
Washingtonia filifera	American Cotton Palm	OWRC	

Key: OWRC = Other Weed of Regional Concern, SP = State Priority Weed, RP = Regional Priority Weed

3.2.2. Threatened Species

No threatened flora species were recorded during surveys. However, database analysis indicates that several threatened flora species have been recorded from the locality.

An analysis of the likelihood of occurrence on the subject site for each threatened flora species recorded within the locality is provided in **Appendix B**. This assessment concluded that due to the highly modified nature of the subject site, no habitat for threatened flora species is present and no threatened flora species are likely to occur.

3.3. Fauna

3.3.1. Fauna Habitat

Fauna habitats of the subject site include:

- Planted areas of trees and shrubs;
- Lawns;
- Artificial wetlands; and
- The shores of the Cooks River.

Of these habitats, grasslands dominate (approximately 69% of the vegetation within the subject site), followed by areas of planted native trees and shrubs (approximately 26% of the vegetation within the subject site) (see **Figure 7**). The habitat value of most of the subject site is therefore quite limited for fauna by mowing to maintain the golf course.

Notwithstanding the dominance of lawns, some vegetation and the artificial wetlands of the subject site provide habitat for fauna including a limited number of threatened species. Microhabitats present within the subject site include tree hollows, water bodies, decorticating bark and ground litter (see **Table 6** below for details and **Figure 8** for locations of habitat features).

Flowering and fruiting trees and shrubs that support insects for microchiropteran bats and blossoms, fruit and nectar for flying foxes occur within the planted vegetation of the subject site. Amongst such trees, *Melaleuca quinquenervia* (Swamp Paperbark) and Figs (*Ficus*) provide high quality forage for flying foxes when in flower or fruit. During surveys in early 2017, it was evident that the Grey-headed Flying-fox (*Pteropus poliocephalus*) utilises all areas of the subject site containing *Ficus* spp. or flowering *Melaleuca quinquenervia* trees.

A limited number of older trees also have tree hollows that could provide shelter opportunities for some birds and bats. Five trees containing hollows were identified during surveys. Most of the hollows were medium in size (10-15cm in diameter) and were located within *Ficus* spp. trees located in the northwest corner of the subject site, near the existing club house. These hollows are suitable for arboreal mammals such as the Common Brushtail Possum (*Trichosurus vulpecular*) and small to medium sized birds, such as the Sulphur-crested Cockatoo (*Cacatua galerita*) and Rainbow Lorikeet (*Trichoglossus moluccanus*).

Decorticating bark and ground litter occurs occasionally throughout the groves of trees and shrubs across the subject site. The majority of areas containing such debris are located within landscaped areas of the golf course around planted trees. As such, this type of habitat occurs in isolated patches bound by mown grass, offering little connectivity to adjacent areas of similar habitat.

Aquatic habitat in the subject site is present in the form of drainage lines, ephemeral soaks, a tidal influenced drainage channel and man-made ponds. The aquatic habitats present afford suitable habitat for fish, reptiles, amphibians and birds. Permanent water bodies offering the most suitable habitat for native fauna are located within the central to southern sections of the subject site, while ephemeral soaks that would only be utilised after times of heavy rain are located in the northern section of the subject site.

The lawns of the golf course are relatively sterile habitats, particularly by day. However, longer grasslands and shrub lands near ponds and drainage channels provide habitat for foraging by frogs and birds. The threatened Green and Golden Bell Frog is known to forage in such grassland areas and has been recorded in the south-western corner of the subject site.

Table 6 Fauna habitat features recorded within the subject site

Habitat ID	Habitat Type	Description of Habitat Feature
H1	Habitat tree	Ficus sp. (potential hollows for arboreal mammals)
H2	Drainage Line	Potential habitat for amphibians after times of rain
H3	Ephemeral Pond	Potential habitat for amphibians after times of rain
H4	Habitat tree	1 small and 1 medium hollow
H5	Habitat tree	1 small hollow
H6	Creekline	Suitable habitat for aquatic species
H7	Culvert	Potential microbat roosting habitat
H8	Habitat trees	9 Palm Trees (potential nesting habitat within fronds)
H9	Habitat tree	1 medium stick nest
H10	Habitat tree	Palm tree (potential nesting habitat within fronds)
H11	Pond	Suitable habitat for aquatic species
H12	Habitat tree	1 small mud nest
H13	Pond	Suitable habitat for aquatic species
H14	Culvert	Potential microbat roosting habitat
H15	Drainage Line	Suitable habitat for aquatic species
H16	Habitat tree	Ficus sp. (potential hollows for arboreal mammals)
H17	Habitat tree	Ficus sp. (existing arboreal nest box present)
H18	Habitat tree	1 large hollow and 2 small hollows
H19	Mangroves	Suitable habitat for aquatic species
H20	Habitat tree	Ficus sp. (potential hollows for arboreal mammals)
H21	Habitat tree	Ficus sp. (potential hollows for arboreal mammals)
H22	Habitat tree	Ficus sp. (potential hollows for arboreal mammals)
H23	Habitat tree	2 medium hollows
H24	Habitat trees	~25 Palm trees (potential nesting habitat within fronds)
H25	Habitat tree	2 medium hollows
H26	Habitat tree	Ficus sp. (potential hollows for arboreal mammals)
H27	Pond	Suitable habitat for aquatic species

3.3.2. General Species

Forty-five (46) vertebrate fauna species were recorded within the subject site through incidental observations and targeted surveys, during the 2017 surveys by Cumberland Ecology. The fauna group with the highest number of individual species observed was birds (29), followed by mammals (7), amphibians (5), fish (3) and reptiles (2). **Appendix C** contains a list of all fauna species recorded within the subject site.

3.3.2.1. Birds

Despite the highly disturbed nature of the subject site and its proximity to Sydney Airport, it supports a moderate diversity of birds. Twenty-nine bird species were recorded within the subject site during surveys. The artificial ponds and creek lines within the subject site are utilised by a number of waterbirds including ducks (*Chenonetta jubata* and *Anas superciliosa*), geese *(Anser Anser domesticus*), grebes (*Tachybaptus novaehollandiae* and *Poliocephalus poliocephalus*), herons (*Egretta novaehollandiae*) and ibis (*Threskiornis molucca*). Areas of open grassland adjacent to water bodies are also utilised by many of the waterbirds for foraging. Minimal nesting habitat in the form of hollow bearing-trees is present within the subject site, therefore most hollow-dependant birds recorded, such as the Rainbow Lorikeet, were likely utilising the subject site for foraging purposes only. Areas containing shrubby and treed vegetation provide suitable nesting and foraging habitat for a variety of small to medium sized birds including fairy-wrens, honeyeaters and lorikeets. No threatened bird species were recorded within the subject site.

3.3.2.2. Mammals

The subject site supports a low diversity of mammals, likely due to the highly modified nature of the subject site and its exposure to edge effects. The mammals recorded were mostly arboreal bats, and only two feral terrestrial mammals were recorded; the Red Fox (*Vulpes vulpes*) and Black Rat (*Rattus rattus*). Four microchiropteran bat species (Large Bent-winged Bat, Eastern Freetail-bat, Gould's Wattled Bat and White-striped Free-tailed Bat) and the Grey-headed Flying-fox were recorded within the subject site. Of these, the Grey-headed Flying-fox and the Large Bent-winged Bat are listed as threatened under the BC Act and EPBC Act. These two threatened species were recorded foraging across the subject site.

The habitat present in the subject site provides potential foraging habitat for these species, however sub-optimal roosting habitat for microchiropteran bat species is present as only two trees containing suitable hollows were recorded and all existing buildings that could be utilised for roosting are well maintained, lack entry points, and are therefore unlikely to be utilised. Culverts are present in areas of the subject site, however, all observed culverts periodically fill with water entirely and are therefore unlikely to be utilised for roosting. No Grey-headed Flying-fox camp is located within the subject site and therefore this species does not roost there. Due to the lack of preferred roosting habitat present for bat species recorded within the subject site, the habitat present is likely utilised by bats for foraging purposes only as part of a broader foraging range.

Habitat within the subject site is well suited for the Red Fox and Black Rat. Dense areas of weeds located along drainage lines are likely utilised by the Red Fox for refuge during the day, and open areas within the golf course provide ample foraging habitat. The Black Rat was recorded throughout treed areas of the subject site near waterways and is likely widespread throughout the subject site.

3.3.2.3. Amphibians

The subject site supports a low diversity of amphibian species, with only five species being detected through targeted surveys. The permanent water bodies within the subject site constitute suitable habitat for a number of amphibian species, while ephemeral soaks provide potential breeding habitat. Areas of open grassland adjacent to permanent water bodies offer suitable foraging habitat for some amphibian species, including the Green and Golden Bell Frog. Although a large area of suitable amphibian habitat is present within the subject site, a low number of species was recorded. This is likely due to the presence of Mosquito Fish in all of the

waterways, which is a known predator to native amphibians. The most abundant frog recorded was the Striped Marsh Frog (*Limnodynastes peroni*) which was heard calling throughout most areas of the subject site. No threatened amphibian species were recorded within the subject site during the 2017 field surveys; however, two individuals of the Green and Golden Bell Frog were recorded during the 2020 surveys. The Green and Golden Bell Frog is discussed below in **Section 3.3.3i** in more detail.

3.3.2.4. Fish

The subject site contains several water bodies that provide habitat for fish species, and several species were recorded through incidental observation: Sea Mullet (*Mugil cephalus*) were observed in high numbers within the tidal influenced creek extending through the centre of the subject site from east to west. Mosquito Fish (*Gambusia holbrook*i) and Long-finned Eel (*Anguila reinhardtii*) or Short-finned Eel (*A. australis*), were found within the permanent artificial ponds and the drainage line in the south of the subject site.

The Mullet and Long or Short-finned Eel are commonly occurring native fishes, while the Mosquito Fish is listed as a Class 3 noxious species in the greater Sydney region.

No threatened fish species were recorded within the subject site and none are considered likely to occur.

3.3.2.5. Reptiles

The subject offers limited habitat for reptiles. Only two species of reptiles were recorded through incidental observations. These included the Eastern Water Skink (*Eulamprus Quoyii*) and the Eastern Long-necked Turtle (*Chelodina longicollis*).

Most of the subject site consists of landscaped areas that lack preferred habitat features for reptiles such as fallen logs and bush rock. Nevertheless, commonly occurring reptiles including skinks and geckos are likely to persist within the subject site.

Ponds and channels within the subject site provide suitable habitat for Eastern Long-necked Turtle.

No threatened reptile species were recorded within the subject site.

3.3.3. Threatened Species

The following threatened species have been recorded within the subject site:

- Large Bent-winged Bat (*Miniopterus schreibersii oceanensis*);
- Green and Golden Bell Frog (*Litoria aurea*); and
- Grey-headed Flying-fox (*Pteropus poliocephalus*).

Although not recorded from the subject site, the Powerful Owl (*Ninox strenua*) and several migratory birds listed under the EPBC Act have been recorded from the locality and have potential to occur in the subject site due to the presence of suitable habitat.

A discussion of these species and their likely occurrence within the subject site is provided below.

Appendix D analyses the likelihood of occurrence within the subject site for each threatened fauna species recorded within the locality.

3.3.3.1. Green and Golden Bell Frog

i. Introduction

The Green and Golden Bell Frog (*Litoria aurea*) is a large frog species that is listed as Endangered under the BC Act and Vulnerable under the EPBC Act. The species is found in freshwater marshes, dams or streams with *Typha* (bullrushes) or *Elaeocharis* (spike rushes), often at disturbed habitats. Favourable breeding habitat includes water bodies that are shallow, still or slow flowing, ephemeral and/or widely fluctuating, unpolluted, unshaded, with aquatic plants and free of introduced Mosquito Fish (*Gambusia holbrooki*) and other predatory fish, with terrestrial habitats that consist of grassy areas and vegetation no higher than woodlands, and a range of diurnal shelter sites (OEH 2015) (Department of the Environment 2017).

The Green and Golden Bell Frog was originally a common frog species of the eastern seaboard of much of NSW (Pyke and White 2001) (DEC (NSW) 2005). However, habitat clearing and modification, introduced disease (the Chytrid fungus) and introduced fish (Mosquito Fish) have severely depleted this species. In the Sydney Basin Bioregion, it now remains as a series of highly fragmented, disparate subpopulations (DEC (NSW) 2005). One such subpopulation is referred to as the "Arncliffe Population" and its occurrence is centred upon the Cooks Cove precincts.

ii. Status of the Arncliffe Population

The Arncliffe population first came to be assessed in the 1990s when the M5 Motorway was constructed. The construction of the M5 Motorway bisected its habitat and to compensate for that, fenced and protected breeding ponds were established in what is now an area in the south-western corner of the subject site. These breeding ponds are known as the 'RTA ponds' (**Figure 1**). Formal monitoring of the population started in November 2000, and the population has been monitored annually in and around the breeding ponds since their creation by Dr Arthur White, on behalf of the Roads and Traffic Authority (now Roads and Maritime Service or RMS) (Eco Logical Australia 2016) and more recently by AMBS Ecology and Heritage (AMBS Ecology & Heritage 2020, 2021b, a).

The frog species underwent a decline around 2016 (Eco Logical Australia 2016), possibly due to climatic reasons (low rainfall). The RMS had commissioned work for an EIS for the Westconnex project (the M5 upgrade) and additional fieldwork by Dr White for the EIS located very few frogs in 2016.

The Westconnex project proposal entailed provision to create a series of new breeding ponds at the Marsh Street wetlands. That proposal, put forward as part of the EIS for Westconnex, was also based upon artificial breeding of the species, with adults to be collected and transported off site to use as breeding stock. These proposed measures were included in a 'Green and Golden Bell Frog Plan of Management' (hereafter referred to as the 'RMS management plan') (Eco Logical Australia 2016), prepared for the project. The aim was to release young captive bred frogs back into Marsh Street and the original RTA ponds. In early 2016 the WestConnex project was approved and the RMS management plan for the species was commenced.

More intensive monitoring of Green and Golden Bell Frogs is now occurring for the RMS approved project. In late 2016 and early 2017, Dr White located a small number of frogs (5-6) just south of the subject site, within the land formerly known as the Southern Precinct. Two adults were captured and transported off site as per the approved RMS management plans. Cumberland Ecology also recorded two Green and Golden Bell Frog individuals in the RTA ponds in early 2020. Since this time, as part of the WestConnex project, the Arncliffe population has increased again and continues to be supplemented with tadpoles from the captive breeding program. Based on recent monitoring surveys undertaken by AMBS Ecology and Heritage (AMBS Ecology & Heritage 2020, 2021b, a), the growing Arncliffe population appears to be continue to be mainly based around the RTA ponds as well as the new Marsh Street wetland habitat, with scattered records also occurring within the southern portion of the subject site and in the area of Barton Park and Riverine Park (formerly known as the Southern Precinct).

iii. Existing Habitat within the Subject Site

Areas within the subject site currently provide what was until recently the main habitat areas for the Arncliffe Green and Golden Bell Frog population within the study area. As mentioned, The RTA ponds were created specifically for the Green and Golden Bell Frog and thus provide optimal habitat for the frogs. These ponds form the primary breeding habitat on site for the Green and Golden Bell Frog and are the only areas known to be consistently used for breeding within the subject site (AECOM 2015) (Eco Logical Australia 2016) (Rockdale City Council 2014).

Additional areas of suitable habitat for the species, albeit sub-optimal, consists of grassed areas located near water bodies, and the water bodies themselves, primarily the existing artificial ponds in the current Kogarah Golf Course and the drainage line located along the southern boundary of the subject site. These form part of the species foraging and dispersal habitat within the subject site. However, the majority of the Kogarah Golf Course ponds that historically provided aquatic habitat in the subject site have in recent years been infilled to facilitate the use of this area as the WestConnex New M5 temporary construction compound, in particular the ponds that were located in close proximity to the RTA ponds. As part of the RMS management plan, the area boundary of the temporary construction compound has been fenced with "frog-proof" fencing. This currently limits access to a high proportion of the subject site by the Green and Golden Bell Frog. However, it is noted that the requirements of the WestConnex project includes provisions to reinstate the land disturbed by the temporary construction compound, to pre-existing conditions.

The remaining water bodies within the subject site are mostly located adjacent to the New M5 Arncliffe construction compound, and their already poor condition is likely to have deteriorated further. The artificial ponds and drainage line may be utilised by the species at times, likely only as foraging habitat. Breeding is unlikely to occur in such areas due to the presence of Mosquito Fish (*Gambusia holbrooki*) in all of the waterways in the subject site with the exception of the RTA ponds.

In addition to the RTA ponds, based on the distribution of historical records as well as more recent records documented by AMBS Ecology and Heritage as part of their Green and Golden Bell Frog monitoring surveys, the south-western portion of the subject site represents the habitat that is mostly utilised by the species for foraging and dispersal within the site.

3.3.3.2. Large Bent winged Bat

The Large Bent-winged Bat (*Miniopterus schreibersii oceanensis*) is listed as Vulnerable under the BC Act, although it is not listed under the EPBC Act. It mostly hunts in forested areas, catching moths and other flying insects above the tree tops, however it may potentially utilise the wetlands for foraging as well and occasionally also grassland areas. Caves are the primary roosting habitat, but the species is also known to utilise derelict mines, storm-water tunnels, buildings and other man-made structures (OEH 2016a).

The subject site provides foraging habitat for the Large Bent-winged Bat, and the species was detected by ultrasonic call recording foraging over the subject site during surveys in February 2017 (see **Figure 9**). The species has previously been recorded in the Southern Precinct of the study area, during surveys undertaken by Cumberland Ecology in 2016 (Cumberland Ecology 2016a).It was also included in the Rockdale Biodiversity Strategy as threatened fauna that is known to occur within the Rockdale LGA (Rockdale City Council 2014).

No preferred roosting habitat is present within the subject site as no caves are present. However, this bat species is also known to roost in small groups under bridges and culverts and in buildings. Only some sub-optimal roosting habitat for the species is present within the subject site, as all existing buildings that could be utilised for roosting are well maintained, lack entry points, and are therefore unlikely to be utilised. Culverts are present in areas of the subject site; however, all observed culverts periodically fill with water entirely and are unlikely to be utilised for roosting.

3.3.3.3. Grey-headed Flying-fox

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is listed as Vulnerable under the BC Act and EPBC Act. The Grey-headed Flying-fox is distributed primarily along the eastern coastal plain from Bundaberg in Queensland, through NSW and south to eastern Victoria (NSW Scientific Committee 2004). Within its extent, the Grey-headed Flying-fox occurs in rainforests, open forest, woodlands, Melaleuca swamps and Banksia woodlands (NSW Scientific Committee 2004). The species roosts in camps that are often close to water and within 20 km of a regular food source. The species is known to travel upwards to 50 km to forage, but more commonly commutes less than 20 km (OEH 2016b).

The subject site offers a large area of foraging habitat for the Grey-headed Flying-fox, and the species was recorded foraging in *Ficus* and *Melaleuca* trees throughout the subject site during nocturnal surveys. The species lives in specific roost camps, which were not observed within the subject site during surveys. The closest known camp is the 'Wolli Creek' camp located within Turrella Reserve, approximately 2 km west of the subject site (Department of the Environment and Energy 2015). Although a known camp is in proximity, the habitat within the subject site would only be utilised as part of a much broader foraging range.

3.3.3.4. Powerful Owl

The Powerful Owl (*Ninox strenua*) is listed as Vulnerable under the BC Act. It is the largest Owl in Australia and reaches 60 cm in length and can have a wingspan of up to 140 cm. The Powerful Owl is endemic to eastern and south eastern Australia and in NSW is widely distributed throughout the eastern forests from the coast inland to the tablelands (OEH 2016d). It inhabits a range of vegetation types from woodland and open sclerophyll forest to tall open wet forest and rainforest and generally requires large tracts of forest or woodland habitat but can occur in fragmented landscapes (OEH 2016d). The Powerful Owl requires large tree hollows for

nesting that are at least 50 cm deep in large old eucalypts that have a diameter at breast height of 80-240 cm, and roosts in dense vegetation (OEH 2016d).

Potential foraging habitat for this species occurs throughout the subject site, however it is unlikely to breed as only one large hollow that would potentially be suitable for this species was recorded. The Powerful Owl is considered to have the potential to occur within the subject site given the species is known to utilise fragmented habitat within urban areas; however, the subject site is considered to only provide marginal foraging habitat for this species.

3.3.3.5. Migratory Species

Two species listed as migratory under the EPBC Act have been recorded from the locality and have potential to occur in the subject site. These are the Fork-tailed Swift (*Apus pacificus*) and White-throated Needletail (*Hirundapus caudacutus*) which are aerial species that may forage aerially above the subject site on occasion. It is noted that since the preparation of the original Flora and Fauna Assessment (reference), the White-throated Needletail has also been listed as Vulnerable under the EPBC Act.

3.4. Biodiversity Corridors

The subject site forms part of the Rockdale Wetlands Corridor (Rockdale City Council 2014), which is a biodiversity corridor linking a series of habitats between the Cooks River and Lower Georges Rivers. The series of habitats forming this corridor include estuarine, wetland and bushland habitats, as well as recreational space such as parkland, sports fields and the Kogarah Golf Course. The subject site is mapped as the most northern extent of the Rockdale Wetlands Corridor within the Rockdale Biodiversity Strategy (Rockdale City Council 2014).

4. Impact Assessment

This chapter discusses the potential impacts of the proposed project on the biodiversity values of the subject site. Both direct and indirect impacts have been considered in the impact assessment, with direct impacts being primarily related to vegetation and habitat removal and indirect impacts relating to alteration to hydrological regimes and increase edge effects, resulting from such impacts. Impacts to endangered ecological communities, threatened flora and threatened fauna are also discussed within this chapter. A number of avoidance, mitigation and compensatory measures have been proposed to address the impacts of the proposed project, and are provided in **Chapter 5.**

4.1. Introduction

The total subject site is approximately 36 ha in size. The Master Plan identifies a development precinct of approximately 15 ha, as described in detail within **Section 1.4**. For the purposes of this impact assessment and for the remainder of this report the term 'development footprint' is interchangeable with the development precinct and includes all areas that are to be developed as part of the Cooks Cove Development Zone, including roads and ancillary facilities. The development footprint is shown in **Figure 10**.

It should be noted that some parts of the development footprint overlap with areas that have already been cleared for the existing Westconnex Temporary Construction Compound. Therefore, the areas that would require clearing of vegetation and associated habitat within the subject site is reduced compared to the development footprint. The areas of vegetation to be removed, including areas of landscaped trees or landscaped understorey is shown in **Figure 10**.

4.2. Direct Impacts

4.2.1. Vegetation Removal

The largest direct impact of the proposed project is the removal of vegetation and associated habitats within the development footprint. Although there are different types of flora and fauna habitat within the subject site such as water bodies and ground litter, the most extensive habitat to be impacted is represented by vegetation.

The indicative area requiring vegetation removal is approximately 17 ha. Of the 17 ha, less than 0.01 ha comprises semi-natural plant communities. The remaining area of the development footprint is comprised of planted native and exotic plant communities (16.77 ha), cleared land (largely for WestConnex and parking facilities for the Kogarah Golf Club and for the entirety of Lot 31 DP 1231486) and water bodies with fringing aquatic vegetation. The only TEC occurring within the development footprint (and within the subject site) is the BC Act listed saltmarsh community. Impacts to this EEC are discussed further within **Section 4.4**. An estimation of the areas of each vegetation community to be cleared within the development footprint is provided in **Table 7**. **Figure 10** shows the vegetation communities within the development footprint.

The proposed project will remove approximately 4.36 ha of planted native trees and shrubs within the subject site, comprised of the "Planted Native Vegetation" community. As discussed in **Section 3.1**, this community is not considered to conform to any listed TECs under the BC Act or the EPBC Act. As a result, an assessment of significance of the impacts to this community is not required. However, the potential impacts on threatened fauna species that may occur as a result of the removal of this community in relation to its habitat value, is

discussed in subsequent sections and have been considered within the assessment of significance in **Appendix E**.

Mitigation measures to address the loss of vegetation and associated habitat are addressed in **Chapter 5**.

Table 7 Estimation of areas of vegetation to be removed in the subject site

Vegetation Community	Current Extent (ha)	Removed Extent (ha)
Semi-natural Plant Communities		
Mangroves	0.02	0.00
Saltmarsh	0.01	0.01
Planted Native and Exotic Plant Communities		
Planted Native Vegetation	6.67	4.36
Exotic Vegetation	0.63	0.25
Lawns and other Exotic Grassland	17.40	12.17
Other		
Water Body with Fringing Aquatic Vegetation	0.58	0.18
Subtotal	***25.31***	***16.97***
Cleared Land	10.96	3.53
Total	**36.27**	**20.49**

4.2.2. Loss of Specific Habitat Features

In addition to the clearance of broad habitats, the project will include the removal of specific habitat features within the subject site. Specific fauna habitat features that will be removed by the project include:

- Hollow-bearing trees suitable as shelter and breeding habitat for a range of hollow-dependent fauna;
- Blossom-producing trees and shrubs suitable as forage for a range of frugivores, nectarivores and insectivores; and
- Artificial water bodies that offer suitable aquatic habitat for fish, reptiles, amphibians and birds.

The loss of these habitat features within the development footprint is discussed further below.

The removal of these habitat features also has the potential to directly impact the fauna species utilising the habitats during the clearing process. Although some species, including diurnal species and highly mobile species may relocate during this period, there is potential for fauna to remain within the habitat features, such

as hollows and water bodies. Species with a higher potential to be impacted during the clearing process include nocturnal species, less mobile species and species that are hibernating or in torpor during the clearing period. Additionally, species that have smaller home ranges may not be able to relocate into non-clearing areas. There is potential for injury and mortality during the clearing process to individuals that remain within the clearing areas. If the mitigation measures outlined in **Chapter 5** are implemented, these impacts can be avoided or minimised.

Despite the project resulting in the removal of habitat and specific habitat features, extensive areas of land containing similar habitat occurs within the study area and surrounds. It is anticipated that the types of flora and fauna species utilising the habitat within the development footprint will continue to persist within other areas of the study area where suitable habitat is present. The habitats within the study area are connected with similar habitats within the locality, through the Rockdale Wetlands Corridor (Rockdale City Council 2014).

4.2.2.1. Hollow-bearing Trees

Trees containing hollows are largely absent from the subject site, and only five individual hollow-bearing trees were identified during surveys (see **Section 3.3.1**). Allowance has been made in the design for the proposed project to retain and incorporate some of the hollow-bearing trees and trees with potential hollows to reduce the impacts on native fauna that may utilise these trees as nesting or roosting habitat. The retained trees include some of the hollow-bearing *Ficus* spp. that are in the northwest corner of the subject site, near the existing club house.

Nevertheless, the proposed project will also remove a number of hollow-bearing trees. Mitigation measures are provided within **Chapter 5** and include the installation of nest boxes within the study area to address the loss of potential roosting habitat.

4.2.2.2. Blossom-producing Trees

A suite of blossom-producing trees that provide foraging opportunities for wildlife occur within the development footprint that will be cleared by the proposed project. These include *Eucalyptus robusta* (Swamp Mahogany), *Melaleuca quinquenervia* (Broad-leaved Paperbark) and *Ficus macrophylla* (Moreton Bay Fig). These trees occur mostly within the Planted Native Vegetation community, of which approximately 4.36 ha will be removed.

The suite of blossom-producing trees occurring within the development footprint is also known to occur within other areas of the immediate surrounds of the study area. It is anticipated that these features will continue to provide habitat for the species utilising this habitat within the subject site. Nevertheless, the potential impact associated with the loss of these blossom-producing trees on threatened species is discussed in subsequent sections and within the test of significance section in **Appendix E**.

Mitigation measures relevant to the loss of blossom-producing trees are provided within **Chapter 5**

4.2.2.3. Water Bodies

Several water bodies are present within the development footprint in the form of drainage lines, ephemeral soaks, a tidal influenced creek and man-made ponds. These water bodies offer some habitat for fish, reptiles, amphibians and birds.

The removal of these aquatic habitats will remove potential foraging and breeding habitat for some fauna species. However, numerous water bodies and wetlands also occur outside the development footprint within the study area and it is anticipated that these features will continue to provide habitat for the suite of species that utilise the aquatic habitats within the subject site. Additionally, the proposed project will create new aquatic habitats within the subject site. Nonetheless, the potential impacts on threatened species in relation to the removal of water bodies within the subject site have been addressed within the test of significance section in **Appendix E**.

Mitigation measures relevant to the removal of water bodies are provided within **Chapter 5.**

4.3. Indirect Impacts

The proposed project may have indirect impacts on the ecological values of remaining vegetation and habitat within the study area, including edge effects, alteration to wildlife corridors, alteration to hydrological regimes and changes to weed occurrence.

Additionally, a number of construction and operational impacts, such as those relating to dust, noise, light and erosion, will also impact the remaining vegetation and habitat. Indirect impacts relevant to the project are considered in more detail below. Whilst it is acknowledged that indirect impacts can potentially be significant for a variety of threatened species, such impacts cannot be mapped or accurately calculated in advance.

Indirect impacts may also be felt outside the study area. For mobile species with large territories, such as the Grey-headed Flying-fox, the clearance of habitat within the development footprint may potentially impact the territories further afield. Whilst not quantifiable, these impacts have been considered within the Tests of Significance within **Appendix E**.

A range of mitigation measures will be implemented to minimise any adverse effects of the proposed project on biodiversity. These measures are considered in **Chapter 5**.

4.3.1.1. Weeds

Alterations to habitat conditions often favour introduced and/or hardy native plant species that can proliferate in disturbed conditions. Such species have potential to impact upon the original local native plant species. Weeds such as exotic grasses and other introduced plants have potential to outcompete regenerating native plant species.

There are 19 Priority Weeds listed under the NSW *Biosecurity Act 2015* currently occurring within the subject site and three of these are also listed as a Weed of National Significance (WoNS). One additional WoNS was recorded within the site. There is a risk that seeds or other propagules from these weeds could be dispersed while the works of the proposed project is being undertaken, on vehicles or clothing of the workers involved. This could potentially be a serious threat to remaining vegetation within the study area and immediate surrounds.

If the mitigation measures outlined in **Chapter 5** are undertaken, then this impact can be minimised.

4.3.1.2. Alteration to hydrological regimes and flows

The cut and fill works and general reshaping of the landform of the subject site for the proposed project have the potential to alter the hydrological flows within the site. Also, the modification of hydrology necessary for vegetation and habitat survival, such as surface water drainage patterns, through the construction of hard surfaces, can impact the retained vegetation communities and their associated habitats. In addition, some fauna habitats within the retained portions of the subject site could potentially be reliant on drainage patterns. Changes to drainage lines can affect the integrity, structure and composition of habitat and thus, have secondary impacts on the species that rely on them. The proposed project may also impact water quality which can create unfavourable conditions for native species.

4.3.1.3. Fragmentation

Fragmentation is the process where habitats that were once continuous become divided into separate fragments isolated from each other by non-forest land (Primack 1993, Fahrig 2003, Lindenmayer and Fischer 2006). This process, together with habitat loss, is a major cause of biodiversity loss and a threat to native species (Rand et al. 2006, Laurance et al. 2007). Habitat fragmentation affects biodiversity by reducing the amount of available habitat for some species to occupy due to increased distances between habitat patches. Plants and other sessile organisms are usually directly removed, while mobile animals (especially birds and mammals) retreat into other remnant patches of habitat (Lindenmayer and Fischer 2006). The displacement of mobile fauna can reduce the survivorship of species in the case where there are limited areas of sufficiently large habitat within dispersal distance to retreat to.

The project has the potential to increase fragmentation somewhat within the study area. The proposed clearing of the majority of the northern and eastern section of the site, where the main development precinct and road network will be located, could potentially isolate patches of treed vegetation to be retained in the north-eastern corner of the site from other patches of retained vegetation within the southern section of the subject site. However, this fragmentation is likely to be a temporary impact, as the intention of the project is to establish a planted corridor along the Cooks River foreshore which would connect with the patch of retained vegetation in the north-east corner, and subsequently restore connectivity to the southern section of the study area.

4.3.1.4. Edge Effects

Edge effects are impacts that occur at the interface between natural habitats, especially forests and disturbed or developed land (Yahner 1988). When an edge is created between woodland and a cleared area, changes to ecological processes within the vegetation can extend between 10 m and 100 m from the edge (Yahner 1988). These include microclimatic changes in light, temperature, humidity and wind, which can favour a suite of different species and therefore cause significant changes to the ecology of the patch (Lindenmayer and Fischer 2006). These changes include; invasion by weeds, increase in feral animals, reduction in tree health, and barriers to dispersal or distribution (Yahner 1988). Edge effects are typically more pronounced in small habitat fragments and they may extend throughout small patches, rendering them unsuitable for some species. In particular, small patches of woodland habitat may be unfavourable for species which require interior habitat. As habitat loss progresses, the understanding of edge effects on ecological processes becomes increasingly important (Rand et al. 2006).

The project will result in edge effects where woody vegetation is cleared within the development footprint. Due to edge effects, the impacts of the project could potentially extend beyond the clearing limits into areas of retained vegetation and the RTA ponds. It is primarily where edges are created between the development precinct and areas of existing woody vegetation that impacts will occur to the ecological value of the habitat that remains.

If the mitigation measures outlined in **Chapter 5** are undertaken, which includes the implementation of specific management plans relevant to the retained vegetation, then this impact can be minimised.

4.3.1.5. Sedimentation, Erosion and Runoff

During the construction of the proposed project the retained vegetation can be impacted by sedimentation, erosion and runoff. Filling of the development footprint to alter the height of the development could potentially increase erosion. Eroded sediment can smother retained vegetation if appropriate control measures are not implemented. Smothering can cause dieback of herbs and shrubs and reduce regeneration of groundcover species. Sediment and eroded material can also contain weed matter and nutrients, and movement of this material into the retained vegetation or the Cooks River can facilitate the spread of weeds. Increased weed invasion can result in changes to community composition and spread of weed to surrounding areas within the locality.

4.3.1.6. Construction and Operational Impacts

A number of indirect impacts relevant to the construction and operational phases of the project have the potential to impact the ecological values of the study area, such as those relating to dust, noise, light and erosion.

A suite of mitigation measures is proposed to minimise the indirect impacts described below. These measures are discussed in **Chapter 5**.

i. Dust

Construction activities can generate dust, which may impact on the ecology within the study area in a number of ways. Dust that settles can accumulate on leaf surfaces and reduce essential physiological processes including photosynthesis, respiration, and transpiration. It can also permit the penetration of phytotoxic gaseous pollutants into plants (Farmer 1993).

Dust can also produce physical effects on plants such as blockage and damage to stomata, shading, and abrasion of leaf surface or cuticle. This can result in cumulative effects such as drought stress on already stressed species. This can result in decreased plant health, and even death in extreme circumstances. Decreased growth and vigour of plants may mean that they are more susceptible to pathogens and other disturbance, and these plants are more likely to be subject to increased mortality. Such impacts to individual plants generally result in decreased productivity and can result in changes in vegetation and community structure (Farmer 1993).

The effect of dust deposition also affects animals that use plants, either as a source of food or habitat. Dust on the foliage and fruit may reduce palatability to animals and decreased health of trees and changed community structure results in a reduction in the amount of available habitat.

Dust pollution can lead to a decrease in habitat quality which has the potential to extend the area of impact beyond the area directly disturbed by the project. With regard to the remaining habitats within the study area, dust generated by the project could impact vegetation within wetland and woodland communities, reducing health of some species within the wetland environments. It could also impact upon potential foraging resources for wildlife, including the Green and Golden Bell Frog.

ii. Noise

Noise can affect animal physiology and behaviour, and if it becomes an ongoing stress, it can be injurious to an animal's energy budget, reproductive success and long-term survival. There are other potential impacts that include habitat loss through avoidance, reduced reproductive success and a retreat away from favourable habitats (AMEC 2005).

Noise also affects the way that animal-created sounds are heard and interpreted by other animals. This can include mating calls, territorial calls and alarm calls. Interference with these calls by noise generated by the project has the potential to disrupt the species relying on these calls with deleterious results including reduced reproductive success and mortality (AMEC 2005).

The project can generate significant noise during construction of infrastructure and buildings. Noise can be generated by large volumes of traffic, particularly large trucks and excavation machinery. Some fauna species are sensitive to elevated levels of noise in their environment and this has the potential to impact negatively on these species (AMEC 2005)

The noise created by the construction of the project is likely to affect native species and affect the value of the habitats that remain. Some species are likely to move in response to noise, and this has the effect of increasing the amount of habitat for native species that will be removed as a result of the proposed project. However, it is likely that most animal species will habituate to the periodic noise disturbance (AMEC 2005), and the construction phase of the project are likely to cause temporary disturbance only to fauna. Furthermore, the impacts from noise emissions are likely to be localised close to the development area and are not likely to have a significant, long-term, impact on wildlife populations.

iii. Light

The project has the potential to increase the level of artificial light in the natural environment during the construction phase. Increased light levels may adversely impact wildlife by direct glare, chronic or periodic increased illumination and temporary unexpected fluctuations in light levels (Saleh 2007, Longcore and Rich 2010).

Research into impacts from altered lighting indicates that it can trigger behavioural and physiological responses that include but are not limited to:

- Changes in foraging behaviour;
- A disruption of seasonal day length cues which trigger critical behaviours (Longcore and Rich 2004, Saleh 2007, Longcore and Rich 2010);
- Disorientation and/or temporary blindness; and

- Interference with predator-prey relationships.

While the construction phase of the project may have some effect on the surrounding environment, the impacts from light pollution are likely to remain close to the disturbance associated with the infrastructure and commercial development, with only limited glare into the surrounding habitats. It is likely that most fauna species would habituate to the periodic disturbance and light pollution from the project is unlikely to have a significant or long-term impact on any fauna species.

4.4. Impacts to Endangered Ecological Communities

Only one EEC was considered to be occurring within the subject site; the BC Act listed 'Coastal saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions'. The proposed project will require the removal of a trace (less than 0.01 ha) of this community.

The areas of the saltmarsh EEC that are proposed to be removed are two very small patches that occur within two open sections of a drainage line which is piped underground for the rest of its extent in the subject site. Due to the small size of these patches, their isolated location within the existing golf course and their artificial nature, the clearing of these areas is not considered to be a significant impact and are considered unlikely to be important for the long-term survival of the local occurrence of this community in the locality. Nevertheless, mitigation measures to address the loss of saltmarsh habitat are addressed in **Chapter 5**.

A permit will likely need to be obtained from the DPI Fisheries before any areas of saltmarsh are cleared, as the saltmarsh is classified as key fish habitat, as well as any areas of Mangrove habitat cleared which is also listed under the FM Act.

4.5. Impacts to Threatened Flora Species

No threatened flora species were recorded as occurring in the subject site during the time of the field survey, despite an intensive survey. Additionally, no threatened flora species are considered to have the potential to occur naturally within the subject site due to the subject site's highly modified nature. Therefore, the proposed project is unlikely to impact on any threatened flora species listed under the BC Act or EPBC Act, or suitable habitat for threatened species.

4.6. Impacts to Threatened Fauna Species

Three threatened fauna species have been recorded within the subject site and a number of other threatened fauna species are considered to have the potential to occur. The following sections outline impacts to the threatened fauna species known within the subject site, or having high potential to occur, and the significance of these impacts.

Tests of Significance for the mentioned species are provided in **Appendix E**. Avoidance, mitigation and compensatory measures to address impacts to threatened fauna are provided in **Chapter 5**, including provisions for ongoing management.

4.6.1. Green and Golden Bell Frog (Litoria aurea)

The Green and Golden Bell Frog (*Litoria aurea*) is listed as Endangered under the BC Act and Vulnerable under the EPBC Act. Although not recorded during Cumberland Ecology's 2017 surveys, a couple of individuals were recorded during the 2020 field surveys and the species is known to occur in the subject site (Eco Logical Australia 2016), as discussed in **Section 3.3.3 i**.

Although the Arncliffe population of Green and Golden Bell Frogs is believed to have experienced a decline in numbers in 2016, and the majority of the remaining population was transported off site as part of the RMS captive breeding program, the population appears to have since increased and continues to be supplemented with tadpoles from the captive breeding program. Based on recent monitoring surveys undertaken by AMBS Ecology and Heritage (AMBS Ecology & Heritage 2020, 2021b, a), the growing Arncliffe population appears to continue to be mainly based around the RTA ponds within the subject site, with scattered records also occurring within the southern portion of the subject site.

The proposed project has the potential to cause direct and indirect impacts to the Green and Golden Bell Frog and associated habitat. The main impact of the project is likely to be the construction and development of land that comprises potential and known foraging and dispersal habitat for the species in the subject site. That notwithstanding, the New M5 Arncliffe construction compounds are currently located directly adjacent to the RTA ponds (see **Figure 1**), and impacts that are occurring as a result are being managed through the implementation of the RMS management plan. Although the existing RTA breeding ponds will be retained in this area, some further reduction of dispersal and potential foraging habitat will take place due to the proposed project in the subject site.

Unless mitigated, the activities associated with the proposed project are likely to impact on the Green and Golden Bell Frog within the subject site, resulting in a range of potential direct and indirect impacts. These impacts are outlined below. However, although some areas of foraging and dispersal habitat will be removed, the only known breeding locations within the subject site will be retained as well as most of the south-western portion of the subject site. Furthermore, a Green and the Golden Bell Frog Management Plan, prepared for this project, will apply to the subject site which incorporates active management with the aim to improve the condition of the habitat present and conserve the Arncliffe population. Any potential residual impacts following the implementation of the mitigation measures will be offset in accordance with the Biodiversity Offset Scheme, through the purchase and retirement of species credits. Thus, the proposed development is unlikely to have a significant impact on the species.

Mitigation measures and compensatory measures relevant to the Green and Golden Bell Frog are discussed in more detail in **Chapter 5**.

4.6.1.1. Potential Direct Impacts

Potential direct impacts of the project include the following:

- Removal of potential foraging, sheltering and dispersal habitat; and
- Potential mortality of frogs from heavy machinery movements within the construction zone

4.6.1.2. Potential Indirect Impacts

Potential indirect impacts may occur to the RTA ponds leading to reduction in the capacity of the ponds to function as habitat including the following:

- Increase in dust from heavy vehicle movements;
- Increase in noise by vehicle movements;
- Increase in light from construction operation;
- Reduction of water quality through sedimentation and contaminants originating from construction zone;
- Accidental introduction of predatory fish;
- Introduction of frog pathogen by construction personnel and construction equipment and machinery;
- Temporary reduction or disruption of habitat connectivity to other habitat areas within the study area;
- Reduction in foraging and dispersal habitat;
- Reduction in breeding success; and
- Potential mortality of individuals as a result of habitat modification.

4.6.2. Grey-headed Flying-fox

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is listed as Vulnerable under the BC Act and EPBC Act. This species was recorded at numerous locations within the subject site during nocturnal surveys, and the species is expected to utilise most of the wooded areas of the subject site for foraging purposes.

The Grey-headed Flying-fox will primarily be impacted by the project through direct removal of foraging habitat within the development footprint. Approximately 4.36 ha of suitable foraging habitat will be removed, which is represented by blossom-producing trees within the planted native woody vegetation. Approximately 2.31 ha of existing tree cover will be retained and additional plantings of native trees and shrubs will occur throughout the subject site.

Although the ongoing loss of foraging habitat is a threatening process to the species, the foraging habitat within the subject site is likely utilised as part of a much broader foraging range. The species is known to travel upwards to 50 km to forage, but more commonly commutes less than 20 km (OEH 2016b). Furthermore, additional areas of suitable foraging habitat within the locality will be retained within reserves in perpetuity. **Figure 11** shows potential foraging habitat within a 20 km radius of the Wolli Creek camp, based on vegetation mapping by OEH (OEH 2016c). In addition to substantial areas of suitable forest and woodland vegetation, there is also a considerable amount of street and garden vegetation within the known foraging range for the Grey-headed Flying-fox, as seen in **Figure 11**, which may also be utilised for foraging by the species (OEH 2016b). The habitat to be removed is therefore unlikely to be important for the long-term survival of a local population in the locality, and the proposed development is considered unlikely to have a significant impact on the Grey-headed Flying-fox.

A range of impact avoidance and mitigation measures have been developed for the project and these are presented in **Chapter 5**. A number of these measures are relevant to the Grey-headed Flying-fox.

4.6.3. Large Bent-winged Bat

The Large Bent-winged Bat (*Miniopterus schreibersii oceanensis*) is listed as Vulnerable under the BC Act, and is not listed under the EPBC Act. The species is known from the locality and was detected within the subject site in February 2017 (see **Figure 9**), and within the land formerly known as the Southern Precinct of the study area during surveys in 2016 (Cumberland Ecology 2016a). Additionally, the Large Bent-winged Bat was included in the Rockdale Biodiversity Strategy as threatened fauna that is known to occur within the Rockdale LGA (Rockdale City Council 2014).

The subject site provides potential foraging habitat for this species, which is likely to be utilised on occasion as part of a broader foraging range. Non-preferred roosting habitat is present in the form of culverts; however, no preferred roosting habitat is present within the subject site as no caves are present.

The Large Bent-winged Bat will primarily be impacted by the proposed project through direct removal of habitat within the development footprint. Approximately 4.37 ha of potential foraging habitat will be removed from the subject site, which is represented by planted native woody vegetation and wetlands. This loss of foraging habitat will result in a net decrease in the amount of suitable habitat available to this species within the study area. However, the foraging habitat to be removed is likely only utilised periodically as part of a broader foraging range and is not considered important to the long-term survival of a local population. Therefore, the proposed development is unlikely to have a significant impact on this species.

A range of impact avoidance, mitigation and compensation measures have been developed for the project and these are presented in **Chapter 5**. A number of these measures are relevant to the Large Bent-winged Bat.

4.6.4. Powerful Owl

The Powerful Owl (*Ninox strenua*) is listed as Vulnerable under the BC Act. No individuals of this species were recorded within the subject site during the current surveys. Nevertheless, the species is considered to have the potential to occur within the subject site given the species is known to utilise fragmented habitat within urban areas; however, the subject site is considered to only provide marginal habitat for this species.

Potential foraging habitat for this species occurs throughout the subject site, however it is unlikely to utilise the subject site for breeding as only one large tree hollow that would potentially be suitable for this species was recorded during recent field survey. The Powerful Owl requires large tree hollows for nesting that are at least 50 cm deep in large old eucalypts that have a diameter at breast height of 80-240 cm, and roosts in dense vegetation (OEH 2014d). As a pre-cautionary measure, the mentioned tree will be retained as part of the proposed project.

The proposed development will remove a relatively small area of potential foraging habitat for this species within the subject site that is likely only utilised periodically as part of a much broader foraging range. Due to this and that the only suitable nesting site within the subject site will be retained; the habitat to be removed is unlikely to be important for the long-term survival of a local population in the locality.

Although a small area of foraging habitat will be removed, this habitat is likely utilised as part of a much broader foraging range. Furthermore, additional areas of suitable foraging habitat within the locality will be retained within reserves in perpetuity and the habitat to be removed is unlikely to be important for the long-term survival of a local population in the locality. The species is also known to utilise isolated street trees and garden areas, which would be present as a result of the proposed development. Therefore, the proposed development is unlikely to have a significant impact on the Powerful Owl.

4.7. Impacts on Biodiversity Corridors

The subject site forms part of the Rockdale Wetlands Corridor, which is a key biodiversity corridor linking a series of habitats between the Cooks River and Lower Georges Rivers (Rockdale City Council 2014). The proposed project will temporarily remove the biodiversity corridor linkage in the northern part of the subject site, as a result of direct removal of vegetation. However, a corridor will be retained in the southern area of the subject site, which will continue to facilitate movement of fauna species between the subject site and the Southern Precinct of the study area, and ultimately retain the linkage within the Rockdale Wetlands Corridor. The retained corridor is large enough to provide significant habitat in its own right for species to exist within, not just pass through.

As mentioned above, the impacts to the biodiversity corridor in the northern section of the subject site involve temporary removal of the linkage. The design for the project includes plantings along the Cooks River foreshore, establishment of various parklands, and plantings of street trees throughout the subject site. These elements contribute to biodiversity corridors and can address linkage gaps (Rockdale City Council 2014). As a result, the biodiversity corridor will be re-established through the subject site, albeit slightly reduced in width.

5. Avoidance, Mitigation and Compensatory Matters

This chapter presents the avoidance, mitigation and compensation measures proposed to ameliorate the impacts of the project on flora and fauna. Although the subject site is highly degraded, a number of threatened species are known to occur, and suitable habitat is present for additional threatened species.

Mitigation measures for the project have been developed in accordance with the following principles:

- Avoid: to the extent possible, developments should be designed to avoid or minimise ecological impacts;
- Mitigate: where certain impacts are unavoidable through design changes, mitigation measures should be introduced to ameliorate the ecological impacts of the proposed development; and
- Compensate: the residual impacts of the project, following the implementation of mitigation measures, should be compensated for in some way to offset what would otherwise be a net loss of habitat.

This chapter provides an assessment of how the hierarchy has been considered for the proposed project.

5.1. Avoidance Measures

Most habitats on the site are planted trees and shrubs, with no substantial area of EECs or other native vegetation occurring. Nevertheless, the subject site provides habitat for several threatened species, including the Arncliffe population of Green and Golden Bell Frog, which is a population that is currently increasing in numbers based on recent monitoring surveys.

The most ecologically significant area on the subject site is the RTA ponds located in the south-western corner of the subject site, which provides the primary habitat for the threatened Green and Golden Bell Frog within the subject site, as well as adjacent areas within the southern portion of the site that provides foraging and dispersal habitat for the species.

Cooks Cove Inlet has limited opportunities to limit or avoid impacts to Green and Golden Bell Frog. This is because the land the corporation owns is not land that has been favoured by the species, which has typically been found closely in association with the RTA ponds and (historically) nearby areas of the golf course. The land closest to the RTA ponds, in the south-western corner of the subject site, is owned by Council, Sydney Water and Transport for New South Wales and as such these entities have the best opportunity for avoidance. Nevertheless, the section below discusses the avoidance measures for the entire subject site, which is the focus of this Planning Proposal.

In order to conserve the primary Green and Golden Bell Frog habitat, the Planning Proposal has been designed to avoid impacts to south-western corner of the site. The current Master Plan involves a development scheme that is set back significantly further away from the RTA ponds compared to the approved plans included in Eastern Precincts SEPP (formerly SREP 33). As a result, the RTA ponds will be retained. Furthermore, the wider south-western portion of the subject site will be retained as passive recreational space and will therefore be utilised much the same as within the current golf course under an open space plan. Within this area of the subject site, in accordance with requirements for the approved major projects SSI 6788 New M5 Motorway and SSI 8931 F6 Extension Stage 1, the existing Green and Golden Bell Frog habitat will be subject to maintenance and enhancement. Habitats that have been temporarily removed or altered will also be reinstated to conditions consistent to that prior to construction.

Key avoidance measures undertaken during the development of the Master Plan specific to the Green and Golden Bell Frog habitat in the subject site include:

- Positioning of development precinct within the northern and eastern section of the subject site, to avoid the primary Green and Golden Bell Frog habitat and immediate surrounding foraging and dispersal habitat areas; and
- Retain the RTA ponds and surrounding vegetation, to avoid impacts to the Green and Golden Bell Frogs primary habitat.

Additionally, although trees containing hollows are not abundant within the subject site, the majority of hollow-bearing trees and trees with potential hollows are located within *Ficus* spp. located in the northwest corner of the subject site, near the existing club house. Allowance has been made in the design for the proposed project to retain and incorporate some of these *Ficus* spp. within the development, to reduce the impacts on native fauna that potentially utilise these trees as habitat.

Scattered planted trees will be retained where possible and incorporated into future open space areas.

5.2. Mitigation Measures

A range of mitigation measures will be implemented for the proposed project. These measures will be implemented to minimise impacts to biodiversity values, and to provide ongoing management of native fauna species and retained and replanted vegetation, and to guide the overall management of the open space corridors and other landscape elements.

It should be noted commitment to implement the mitigation measures outlined below are mainly limited to the development precinct, which represents the land owned by Cooks Cove Inlet. However, as part of this assessment it is recommended that the proposed mitigation measures are also adopted for all land outside of the development precinct within the subject site.

It is also recognised that the detailed design for mitigation measures involving habitat creation and plantings along the Cooks River foreshore will be subject to consultation with Sydney Airport, as National Airport Safety Framework Guideline C: Managing the Risk of Wildlife Strikes in the Vicinity of Airports is not supportive of land uses in proximity to the airport that increase the probability of bird strike.

It is noted that under the Eastern Precincts SEPP there is a requirement for the preparation of a Wetland Environmental Management Plan. As described in ***Section 1.3.2.3*** of this report, the existing wetlands within the broader Cooks Cove site all occur within the southern portion of the study area, outside of the subject site. The only small areas of saltmarsh vegetation that occur within the subject site are artificial. Therefore, the preparation of a Wetland Environmental Management Plan is assumed to not be required for the Cooks Cove Planning Proposal. However, if conditions would change for a future DA, the requirement for the preparation of such a plan can be revisited.

The following mitigation measures will be incorporated into site specific DCP controls for the Cooks Cove Planning Proposal area and will be implemented to minimise any adverse effects of the proposed project on biodiversity:

- Implementation of a Green and Golden Bell Frog Management Plan;
- Vegetation Clearance and Fauna Management Protocols;
- Weed Control Measures;
- Nest Box Installation;
- Plantings along Cooks River foreshore;
- Habitat Creation; and
- Preparation of a Landscape Management Plan

In addition to these measures, inductions for contractors and visitors are recommended to address the locations of sensitive flora and fauna and outline their roles and responsibilities for the protection and/or minimisation of impacts to biodiversity values.

The proposed mitigation measures are discussed in more detail below.

5.2.1. Green and Golden Bell Frog Management Plan

To manage and minimise the potential impacts to the Green and Golden Bell Frog as a result of the project, a Green and Golden Bell Frog Management Plan has been prepared in accordance with the Eastern Precincts SEPP for the study area. The overall objectives of this Management Plan are to ensure that the current population of the GGBF at Cooks Cove is maintained, to minimise threatening processes at the site and to improve habitat and connectivity for the species to enable successful breeding and on-going population viability.

Specific management measures that will be undertaken to achieve these objectives include the following:

- Retain the existing breeding ponds subject to consultation with the RMS;
- Manage existing frog populations during construction by erecting frog proof fencing and conducting pre-clearance surveys;
- Increase connectivity between sites to encourage breeding;
- Maintain breeding ponds;
- Improve water quality;
- Undertake population monitoring and reporting;
- Provide for long-term habitat protection and management; and
- Address other Key Threatening Processes

This plan provides general plans for the management of the GGBF and its habitat in the study area, but a detailed management protocol and contingency plan (referred to here as the GGBF Construction Plan) will also

be produced at the detailed design phase of the project to deal with the detailed management of the Green and Golden Bell Frog prior to and during construction.

As part of this Planning Proposal, it is proposed that the Green and Golden Bell Frog Management Plan will be updated in the detailed design stage associated with the proposed development, to include further details relevant to the subject site. At this stage, the detailed plans for the open space areas within the development precinct and other areas of the subject site will have been developed and that information can then be built into the updated management plan.

It is also anticipated that this plan will be updated and adapted progressively, in response to new information and any potential changes in the development layout.

5.2.2. Vegetation Clearance and Fauna Management Protocols

5.2.2.1. Delineation of Clearing Areas

To avoid unnecessary removal or damage to vegetation adjacent to the proposed development area, the clearing area should be clearly demarcated and signed, where appropriate, to ensure no vegetation beyond these boundaries is removed.

Areas that require clearance will be flagged and clearly delineated by temporary fencing to ensure that no areas intended for conservation will be inadvertently cleared during the construction process. No machinery will be parked on areas beyond the temporary fencing and no access will be allowed during construction. Ancillary facilities such as stockpile sites, site compounds and construction zones will not be located beyond the limits of clearing.

In order to prevent mortality of Green and Golden Bell Frogs as a result of construction activities, a frog-proof fence will be erected around the boundary of the development precinct prior to construction within the subject site. Further details in relation to the frog-proof fencing protocol, and the timing and duration of the confinement of the frog population, will be provided within the updated Green and Golden Bell Frog Management Plan.

Once construction in each area has been completed, the frog-proof fencing around the development precinct will be removed to allow the frogs to continue to forage within suitable areas in the subject site.

5.2.2.2. Pre-clearance and Clearance Surveys – General Procedures

Pre-clearing surveys are to be undertaken by a suitably qualified ecologist. Pre-clearing surveys will include:

- Demarcation of key habitat features as hollow-bearing trees, fallen logs and bushrock;
- Checking trees for the presence of bird nests and arboreal mammals, such as possums, gliders and bats, prior to felling;
- Animals found to be occupying trees and habitat will be safely removed before the clearing of trees and relocated into nearby woodlands; and

- Provision of a report following the completion of a pre-clearing survey, detailing the location and type of each habitat feature.

To minimise impacts to native fauna species, clearing should be undertaken in the following two-stage process under the supervision of a suitably qualified ecologist:

- The initial phase of clearing will involve clearing around identified habitat features and leaving the features overnight;
- The second stage will involve clearing of the habitat features left overnight followed by an inspection;

An ecologist should investigate all fallen trees for the presence of hollows not detected prior to clearing. Inspections should be undertaken of these hollows for native fauna.

An ecologist should be present while clearing to rescue animals injured during the clearance operation. Provisions will be made to protect any native fauna during clearing activities by the following means:

- All persons working on the vegetation clearing will be briefed about the possible fauna present and should avoid injuring any present;
- Animals disturbed or dislodged during the clearance but not injured should be assisted to move to the adjacent bushland or other specified locations; and
- If animals are injured during the vegetation clearance, appropriate steps will be taken to humanely treat the animal (either taken to the nearest veterinary clinic for treatment, or if the animal is unlikely to survive, it will be humanely euthanized).

5.2.2.3. Pre-clearance and Clearance Surveys – Green and Golden Bell Frog

Pre-construction clearance frog surveys will be conducted prior to each stage of the construction process in the subject site. The purpose of these surveys will be to remove all Green and Golden Bell Frogs from the construction area. Any Green and Golden Bell Frogs found during pre-clearance surveys will be placed outside the construction area where suitable foraging and shelter habitat occurs. Where freshwater ponds/channels occur within construction zones, Green and Golden Bell Frog spawn and tadpole searches will take place prior to and during pre-clearance surveys and spawn/tadpoles moved from construction zones to adjacent freshwater ponds outside. A tadpole and spawn protocol will be prepared and outlined within the Green and Golden Bell Frog Construction Plan, which will include guidelines for the relocation of tadpoles and spawn.

All surveys will comply with the 'NSW Survey Guide for Threatened Frogs – A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method' (DPIE 2020).

Further site inspections will take place during construction to ensure that the Green and Golden Bell Frog are not colonising the construction site. The frequency and duration of such additional surveys will be determined as required according to the weather conditions and data available from the pre-clearance surveys. Any Green and Golden Bell Frogs located in the construction area will be transferred back to the RTA breeding ponds.

Further details of the proposed pre-construction procedures relevant to the Green and Golden Bell Frog will be provided within the Green and Golden Bell Frog Management Plan.

5.2.2.4. Decommissioning Procedure for Golf Course Ponds and Waterways

The current Kogarah Golf Course configuration includes five discrete golf course ponds and waterways within the subject site. If required, a decommissioning procedure for any impacted ponds and waterways will be prepared at the detailed design phase of the proposed project.

The timing and method of de-watering the ponds will be managed by engineers, while a qualified ecologist will be present during the process. Any native aquatic fauna species will be captured and relocated to a predetermined location. Any alien fauna species will be destroyed according to current standards and guidelines. It is assumed that eels, turtles and fish may be present with the ponds and waterways.

5.2.3. Weed Control Measures

In order to minimise the spread of weeds throughout the site and spread of weeds present in the site to areas outside of the site, appropriate weed control activities will be undertaken. Prior to construction, weeds present in the construction area will be identified and controlled if necessary to prevent spread.

A wash-down station will be established and all construction vehicles entering and leaving the site will be required to be washed down to prevent weed seeds entering or leaving the site. These procedures will also assist in preventing the introduction of *Phytopthera cinnamomi*, which is a pathogen of native vegetation that is carried in contaminated soil.

5.2.4. Nest Box Installation

As discussed within the Avoidance Measures in **Section 5.1**, trees containing hollows are not abundant within the subject site. Although allowance has been made in the design for the proposed project to retain and incorporate some of the existing hollow-bearing trees and trees with potential hollows within the development, to reduce the impacts on habitat features, the proposed project will still involve removal of a number of hollow-bearing trees.

To minimise the impact on native fauna that would potentially utilise these hollows for roosting or nesting, nest boxes will be installed in areas of retained tall vegetation within the study area to provide roosting or nesting habitat for birds, micro-bats and arboreal mammals. A Nest Box Management Plan will be prepared in the detailed design stage of the project, and will identify suitable locations for nest boxes and will include relevant management and monitoring objectives.

5.2.5. Plantings along Cooks River Foreshore

The ecological significance of the Cooks River will be improved due to the proposed plantings of mangroves along sections of the river bank. Currently, exotic grassland adjoins the western bank of the Cooks River in the majority of places within the site, with the bank itself consisting of a rock wall. This will be replaced with native woodland plantings along the banks of the river, which will provide a vegetated riparian buffer.

The native-woodland and shrubland plantings along the corridor will provide additional fauna habitat for common species that are known to utilise the site and potentially for threatened, wide ranging bat species

such as the Grey-headed Flying-fox as well as insectivorous species. The riparian corridor will also function as a pedestrian walk-way/cycle-way to allow members of the public to enjoy the recreational space.

The proposed measures will minimise the impact to the Cooks River and assist in working towards goal 2 of the Rockdale Biodiversity Strategy (2014).

'The ecological values of Rockdale's wetlands and waterways are protected and enhanced.'

As recognised within the Rockdale Biodiversity Strategy (2014) the establishment of riparian buffers will be restricted in many locations if the river has been channelized with brick or concrete. In such areas, the plantings will be limited to native woodland. However, to the extent possible, the proposed project will seek to naturalise the Cooks River foreshore and provide adequate riparian buffer areas to minimise any potential impacts to the Cooks River.

5.2.6. Habitat Creation

As part of the mitigation measures for the impacts of the project, areas of aquatic habitat will be created in the subject site. This includes wetland habitat, mangroves, and potential Green and Golden Bell Frog foraging ponds. Further details are provided below.

5.2.6.1. Wetland Habitat

In order to minimise the impacts to aquatic habitat within the subject site, a range of new wetland habitats will be created within the proposed Pemulwuy Park South in the southern portion of the subject site and along the foreshore, adjacent to the Cooks River. The proposed wetland habitat will include both semi-aquatic plantings and marshland, including saltmarsh and reedland communities.

Areas where new saltmarsh and/or reedland are to be revegetated will be delineated and replanted at the earliest stages of the project in order to maximize the opportunity for colonisation by native fauna and reduce the impacts upon such fauna from the clearance of other areas of the site.

The establishment of new wetland habitats also provides opportunities for the creation of new foraging habitat for various species, including the Green and Golden Bell Frog. The wetland areas will be planted with reeds and emergent vegetation to provide additional foraging areas for the species and to make them attractive to other wildlife. These areas will complement the proposed new frog ponds that will be established by the TfNSW in the south-western area of the subject site.

The existing wetland areas and the newly created ones will be subject to ongoing weed removal and a management programme.

5.2.6.2. Mangroves

In order to compensate for any potential indirect impacts on the mangrove habitat in the south-eastern corner of the subject site, mangroves will be planted in areas along the Cooks River to improve fish nursery habitat along the Cooks River and to continue to provide aquatic habitat within the subject site. Currently the constructed river bank forms a concrete channel, which offers no sheltered areas for juvenile fish. The mangrove planting will alter the shape of the river bank, providing sheltered areas within the mangroves for fish and molluscs as well as visual improvements to the river bank which will be enjoyed by the public.

5.2.7. Landscape Management

As discussed within the Rockdale Biodiversity Strategy (2014), sensitively designed landscaped areas, such as recreational open space, contribute to biodiversity corridors. The document also notes that even open space areas without significant vegetation, such as sports field, provide some form of foraging habitat.

The design of the proposed project comprises a number of recreational open space areas, including parks and passive recreation areas where suitable plantings of trees and shrubs can be included.. Street trees and garden plantings can be used to establish linkages and address biodiversity corridor gaps (Rockdale City Council 2014).

The landscape management will include careful consideration of the species used for the plantings or the proposed open space and street tree areas, as well as the layout of these areas. Tree species will be comprised of suitable seasonal feed trees suitable for species such as the Grey-headed Flying-fox (e.g. *Eucalyptus robusta, Melaleuca quinquenervia* and *Banksia serrata*), as a long-term strategy to minimise the impact of loss of foraging habitat. Details of the layout of revegetation areas and species use for planting will be provided in a Landscape Management Plan, in the detailed design stage.

5.2.8. Other Relevant Measures

The following mitigation measures have been and/or are proposed to be undertaken within the planning process and during the construction/operational phase

Planning-related mitigation measures include:

- Staged development which will allow fauna to relocate into adjacent vegetation without assistance by using surrounding habitat connectivity to facilitate dispersal.

General construction mitigation measures include:

- Dust management - to minimise the impacts to vegetation and habitat quality;
- Noise management - to minimise impacts to fauna species;
- Erosion and sedimentation controls - to minimise the impact to adjacent vegetation and downstream environments;
- Stormwater management, through the implementation of a stormwater management plan - to minimise impacts to adjacent vegetation and habitat, and to provide stormwater control devices that could serve as potential habitat for fauna;

General operational mitigation measures include:

- Ongoing erosion and sediment control;
- Ongoing stormwater management;
- Promotion of community awareness of biodiversity values of the retained vegetation and associated habitats; and

- Inspections to monitor effectiveness of mitigation measures and provisions for adaption as required.

Details of these construction and operational mitigation measures are to be included with any construction management plan, as well as in relevant management plans such as the storm water management plan, soil and water management plan, and sediment management plan. Further details will also be included in the updated Green and Golden Bell Frog Management Plan.

5.3. Compensatory Measures

The residual impacts of the project, following the implementation of the mitigation measures discussed in the previous section, will need to be compensated for in some way to offset what would otherwise be a net loss of habitat resulting from construction of the project.

The residual impacts of the proposed project are predicted to mainly be focussed on the loss of potential Green and Golden Bell Frog foraging habitat.

In accordance with the offsetting rules of the Biodiversity Offset Scheme, any residual impact on biodiversity in general, and the Green and Golden Bell Frog in particular will be offset through the purchase and retirement of biodiversity credits in accordance with the offsetting rules under the BC Act. The offsetting liability will be determined in the Development Application stage, through the preparation of a Biodiversity Development Assessment Report under the BAM.

5.4. Adequacy of Mitigation and Compensation Measures

The proposed package of measures will adequately ameliorate the impacts of the proposal on flora and fauna, including threatened species. In accordance with the hierarchy under the BC Act and BAM, the project has implemented reasonable avoidance measures to avoid impacts to the majority of habitat regularly used by the Green and Golden Bell Frogs based on historical and recent records. A suite of mitigation measures will be implemented for the project to ameliorate any impacts remaining following avoidance, including implementation construction mitigation measures, provision and implementation of environmental management plans, and provision of measures that complement requirements associated with the approved major projects SSI 6788 New M5 Motorway and SSI 8931 F6 Extension Stage 1 for the Green and Golden Bell Frog habitat within the south-western portion of the subject site.

Any residual impacts remaining after the implementation of avoidance and mitigation measures will be dealt with under the Biodiversity Offset Scheme and in accordance with the BAM, which includes the purchase and retirement of biodiversity credits.

6. Conclusion

The Cooks Cove Planning Proposal (pertaining to the area previously known as the Northern Precinct) currently comprises the Kogarah Golf course, a compound for the WestConnex New M5 tunnelling works and the RTA Frog Ponds. As a result of historical and recent land uses, the subject site comprises a highly modified, landscaped, and filled, and no original vegetation remains. Despite the impacts of previous disturbance and location within a fragmented landscape, the subject site does provide suitable habitat for a number of native fauna species, including some threatened fauna species.

The redevelopment of the subject site will involve the removal of a limited area of largely planted/exotic vegetation, dominated by Planted Native Trees and Shrubs, Exotic Vegetation, Exotic Grasslands and Lawns, and Aquatic Vegetation. Planted and exotic vegetation dominates almost 100% of the vegetated areas of the subject site.

One EEC, namely Saltmarsh, which is listed under the BC Act will be impacted by the project. The proposal will require the clearing of a small trace of this community (less than 0.01 ha). The occurrence of this community within the subject site is comprised of two very small patches, isolated within two open sections of an artificial drainage line which is piped underground for the rest of its extent in the subject site. Although there will be an impact to the saltmarsh community within the subject site, the overall impact on the community in the study area and the wider locality is not considered to be of major ecological significance.

No threatened flora was recorded within the subject site and none are considered likely to occur. The vegetation and water bodies within the subject site provides habitat for a range of native species, including some threatened fauna species as listed under the BC Act and/or EPBC Act. A total of four listed fauna species have known or potential habitat within the subject site, including the Green and Golden Bell Frog (*Litoria aurea*), Large Bent-winged Bat (*Miniopterus schreibersii oceanensis*), Grey-headed Flying-fox (*Pteropus poliocephalus*) and Powerful Owl (*Ninox strenua*). None of these threatened fauna species are likely to be significantly impacted by the project. The breeding habitat for the Green and Golden Bell Frog within the subject site will be retained; however, a small area of foraging habitat will be cleared.

In recognition of the potential ecological impacts of the project, avoidance, mitigation and compensatory measures have been proposed. Avoidance measures include avoidance of the RTA ponds, which contain breeding habitat for the Green and Golden Bell Frog, as well as most of the species' known foraging and dispersal habitat, based on historical and recent species records. Mitigation measures proposed for the project will be incorporated into site specific DCP controls for the Cooks Cove Planning Proposal area and will include implementation of Environmental Management Plans, implementation of vegetation clearance and fauna management protocols, weed control measures, nest box installation, plantings, habitat creation, and implementation of a landscape management plan. A suite of other mitigation measures are proposed as part of the detail planning/ Development Application, construction and operational phases of the project.

When avoidance and mitigation measures are considered, it is considered that there may be residual impacts to the Green and Golden Bell Frog through the loss of potential foraging habitat. The net decrease in potential foraging habitat for the species will be compensated for in accordance with the Biodiversity Offset Scheme, through the purchase and retirement of species credits.

The proposed avoidance, mitigation and compensatory measures are likely to sufficiently ameliorate the impacts of the project to the extent that no EECs or threatened species are likely to become extinct as a result of the project. Moreover, the long-term objective of these measures is to provide for a net benefit to biodiversity within the Cooks Cove site, through the provision of measures that complement requirements associated with the approved major projects within the south-western portion of the subject site, and other open space areas within the development precinct, to enhance and embellish the Green and Golden Bell Frog habitat to support the long-term survival of the Arncliffe population.

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APPENDIX A :
Flora Species List

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Table 8 Flora species recorded within the subject site

Species Name	Common Name	Exotic	Q1	Q2	Q3	Q4	Q5	Q6	Q7	RMS1	RMS2	RMS3	RMS4	RMS5	RMS6	Incidental
Canopy																
Avicennia marina	Grey Mangrove				X											
Liquidambar styraciflua	American Sweetgum	*										X				
Phoenix canariensis	Canary Island Date Palm	*										X				
Syagrus romanzoffiana	Cocos Palm	*											X			
Casuarina glauca	Swamp Oak		X	X			X									
Gleditsia triacanthos	Honey Locust	*										X				
Acacia binervia	Coast Myall											X				
Cinnamomum camphora	Camphor Laurel	*												X		
Lagunaria patersonia	Norfolk Island Hibiscus	*		X												
Ficus microcarpa var. hillii	Hill's Weeping Fig	*										X				
Ficus macrophylla	Moreton Bay Fig	P								X			X			
Corymbia citriodora	Lemon-scented Gum	*										X				
Eucalyptus amplifolia	Cabbage Gum															X
Eucalyptus botryoides	Bangalay										X					

Species Name	Common Name	Exotic	Q1	Q2	Q3	Q4	Q5	Q6	Q7	RMS1	RMS2	RMS3	RMS4	RMS5	RMS6	Incidental
Eucalyptus botryoides x saligna		*					X			X						
Eucalyptus cladocalyx	Sugar Gum	P									X					
Eucalyptus nicholii	Narrow-leaved Black Peppermint	P														X
Eucalyptus obstans?	Port Jackson Mallee	P														X
Eucalyptus robusta	Swamp Mahogany						X			X						
Eucalyptus sideroxylon	Mugga Ironbark	P								X						
Melaleuca quinquenervia	Broad-leaved Paperbark		X				X		X							
Ligustrum lucidum	Large-leaved Privet	*												X		
Pinus radiata	Radiata Pine	*								X						
Banksia integrifolia	Coast Banksia											X				
Salix babylonica	Weeping Willow	*									X					
Celtis sinensis	Japanese Hackberry	*										X				
Ulmus parvifolia	Chinese Elm	*										X		X		
Sub-canopy																
Avicennia marina	Grey Mangrove				X											
Schinus areira	Pepper Tree	*									X					
Casuarina cunninghamiana	River Oak										X					

Species Name	Common Name	Exotic	Q1	Q2	Q3	Q4	Q5	Q6	Q7	RMS1	RMS2	RMS3	RMS4	RMS5	RMS6	Incidental
Casuarina glauca	Swamp Oak										X			X		
Cupressus sp.		*											X			
Acacia saligna	Golden Wreath Wattle	*												X		
Brachychiton acerifolius	Flame Tree	*														X
Lagunaria patersonia	Norfolk Island Hibiscus	*									X			X		
Melia azedarach	White Cedar	*										X		X		
Ficus benjamina		*									X		X			
Ficus microcarpa var. hillii	Hill's Weeping Fig	*									X					
Morus alba	White Mulberry	*												X		
Corymbia maculata	Spotted Gum	P									X					
Eucalyptus cladocalyx	Sugar Gum	P								X						
Eucalyptus microcorys	Tallowwood	*										X				
Eucalyptus punctata	Grey Gum	P										X				
Eucalyptus robusta	Swamp Mahogany									X						
Leptospermum laevigatum	Coast Teatree										X					
Lophostemon confertus	Brush Box	*										X				
Melaleuca quinquenervia	Broad-leaved Paperbark													X		

Species Name	Common Name	Exotic	Q1	Q2	Q3	Q4	Q5	Q6	Q7	RMS1	RMS2	RMS3	RMS4	RMS5	RMS6	Incidental
Metrosideros excelsa		*									X					
Olea europaea subsp. cuspidata	African Olive	*										X				
Pittosporum undulatum	Native Daphne													X		
Banksia serrata	Old-man Banksia												X			
Salix babylonica	Weeping Willow	*						X						X		
Populus nigra L. 'Italica'	Lombardy Poplar	*									X					
Celtis sinensis	Japanese Hackberry	*												X		
Shrubs																
Avicennia marina	Grey Mangrove				X											
Schefflera arboricola	Dwarf Umbrella Tree	*						X			X		X			
Washingtonia filifera		*											X			
Jacaranda mimosifolia	Jacaranda	*								X			X			
Buxus microphylla	Japanese Box	*											X			
Casuarina glauca	Swamp Oak			X											X	
Ricinus communis	Castor Oil Plant	*												X		
Gleditsia triacanthos	Honey Locust	*												X		
Acacia baileyana	Cootamundra Wattle	*										X				

Species Name	Common Name	Exotic	Q1	Q2	Q3	Q4	Q5	Q6	Q7	RMS1	RMS2	RMS3	RMS4	RMS5	RMS6	Incidental
Acacia longifolia subsp. longifolia	Sydney Golden Wattle											X				
Acacia longifolia subsp. sophorae	Coastal Wattle													X		
Acacia podalyriifolia	Queensland Silver Wattle	*										X				
Lagunaria patersonia	Norfolk Island Hibiscus	*								X						
Melia azedarach	White Cedar												X			
Agonis flexuosa	Western Australian Peppermint	*								X						
Backhousia citriodora		*						X								
Callistemon citrinus	Crimson Bottlebrush	P	X										X			
Callistemon viminalis	Weeping Bottlebrush												X			
Corymbia ficifolia	Albany Redgum	*										X				
Kunzea ambigua	Tick Bush									X						
Leptospermum laevigatum	Coast Teatree	*						X								
Leptospermum petersonii	Lemon-scented Teatree	*								X			X			

Species Name	Common Name	Exotic	Q1	Q2	Q3	Q4	Q5	Q6	Q7	RMS1	RMS2	RMS3	RMS4	RMS5	RMS6	Incidental
Melaleuca armillaris	Bracelet Honey-myrtle	*								X						
Melaleuca leucadendra		*										X				
Melaleuca linariifolia	Flax-leaved Paperbark											X				
Syzygium luehmannii	Small-leaved Lilly Pilly											X				
Tristaniopsis laurina	Water Gum	P										X				
Nandina domestica	Japanese Sacred Bamboo	*											X			
Glochidion ferdinandi	Cheese Tree	P						X								
Pinus radiata	Radiata Pine	*								X						
Pittosporum undulatum	Native Daphne													X		
Banksia integrifolia	Coast Banksia										X					
Banksia robur	Swamp Banksia												X			
Banksia spinulosa	Hairpin Banksia	P								X						
Grevillea 'Robyn Gordon'		*										X	X			
Stenocarpus sinuatus	Firewheel Tree	*								X						
Murraya paniculata	Mock Orange	*								X			X			
Cupaniopsis anacardioides	Tuckeroo									X						

Species Name	Common Name	Exotic	Q1	Q2	Q3	Q4	Q5	Q6	Q7	RMS1	RMS2	RMS3	RMS4	RMS5	RMS6	Incidental
Cestrum parqui	Green Cestrum	*												X		
Lantana camara	Lantana	*												X		
Ferns and Allies																
Nephrolepis cordifolia	Fishbone Fern	*											X			
Climbers/Vines																
Araujia sericifera	Moth Vine	*						X						X		
Dicots																
Hypoestes phyllostachya	Polka Dot Plant	*											X			
Amaranthus retroflexus	Redroot Amaranth	*					X									
Cyclospermum leptophyllum	Slender Celery	*											X			
Foeniculum vulgare	Fennel	*												X		
Hydrocotyle bonariensis		*						X		X				X		
Bidens pilosa	Cobblers Pegs	*						X		X				X		
Conyza bonariensis	Flaxleaf Fleabane	*	X	X		X	X		X					X		
Conyza sumatrensis	Tall Fleabane	*					X							X		
Cotula coronopifolia	Water Buttons	*									X					

Species Name	Common Name	Exotic	Q1	Q2	Q3	Q4	Q5	Q6	Q7	RMS1	RMS2	RMS3	RMS4	RMS5	RMS6	Incidental
Gamochaeta purpurea	Purple Cudweed	*						X								
Lactuca saligna	Willow-leaved Lettuce	*												X		
Lactuca serriola	Prickly Lettuce	*	X													
Senecio madagascariensis	Fireweed	*								X						
Sonchus oleraceus	Common Sowthistle	*					X			X						
Tagetes minuta	Stinking Roger	*												X		
Taraxacum officinale	Dandelion	*		X				X		X						
Brassica fruticulosa	Twiggy Turnip	*												X		
Lepidium africanum		*	X					X								
Paronychia brasiliana	Chilean Whitlow Wort	*	X			X	X									
Polycarpon tetraphyllum	Four-leaved Allseed	*							X							
Stellaria media	Common Chickweed	*					X									
Atriplex prostrata		*			X						X			X	X	
Chenopodium album	Fat Hen	*												X		
Sarcocornia quinqueflora	Samphire				X						X				X	
Suaeda australis	Seablite				X											
Euphorbia prostrata	Red Caustic Weed	*												X		

Species Name	Common Name	Exotic	Q1	Q2	Q3	Q4	Q5	Q6	Q7	RMS1	RMS2	RMS3	RMS4	RMS5	RMS6	Incidental
Ricinus communis	Castor Oil Plant	*												X		
Medicago polymorpha	Burr Medic	*						X								
Trifolium repens	White Clover	*		X												
Triglochin striata	Streaked Arrowgrass														X	
Lemna disperma	Duckweed	*									X			X		
Malva parviflora	Small-flowered Mallow	*												X		
Modiola caroliniana	Red-flowered Mallow	*		X				X						X		
Sida rhombifolia	Paddy's Lucerne	*												X		
Oxalis corniculata		*		X		X								X		
Bacopa monnieri	Bacopa										X					
Plantago lanceolata	Lamb's Tongues	*												X		
Acetosa sagittata	Rambling Dock	*												X		
Persicaria lapathifolia	Pale Knotweed									X				X		
Polygonum aviculare	Wireweed	*	X													
Portulaca oleracea	Pigweed					X		X		X						
Richardia brasiliensis	White Eye	*												X		
Solanum nigrum	Black-berry Nightshade	*		X									X			
Monocots (Grasses)																

Species Name	Common Name	Exotic	Q1	Q2	Q3	Q4	Q5	Q6	Q7	RMS1	RMS2	RMS3	RMS4	RMS5	RMS6	Incidental
Bromus catharticus	Prairie Grass	*				X										
Cenchrus clandestinus	Kikuyu Grass	*	X	X		X	X	X	X				X	X		
Cenchrus setaceus	Fountain Grass	*								X			X			
Cynodon dactylon	Couch	*	X	X	X	X	X		X							
Digitaria sanguinalis	Summer Grass	*		X										X		
Ehrharta erecta	Panic Veldtgrass	*					X	X								
Eleusine indica	Crowsfoot Grass	*	X													
Eleusine tristachya	Goose Grass	*				X	X									
Eragrostis curvula	African Lovegrass	*												X		
Melinis repens	Red Natal Grass	*												X		
Paspalum dilatatum	Paspalum	*											X	X		
Phragmites australis	Common Reed													X		
Poa annua	Winter Grass	*							X	X						
Sporobolus africanus	Parramatta Grass	*	X	X		X	X		X							
Stenotaphrum secundatum	Buffalo Grass	*	X	X			X	X						X		
Monocots (Other)																
Clivia miniata	Natal Lily	*											X			
Monstera deliciosa	Fruit Salad Plant	*											X			
Asparagus aethiopicus	Ground Asparagus	*											X	X		

Species Name	Common Name	Exotic	Q1	Q2	Q3	Q4	Q5	Q6	Q7	RMS1	RMS2	RMS3	RMS4	RMS5	RMS6	Incidental
Cordyline stricta	Narrow-leaved Palm Lily	*											X			
Canna indica	Tous-les-mois Arrowroot	*												X		
Commelina cyanea														X		
Tradescantia pallida	Purple Queen	*											X			
Bolboschoenus caldwellii											X				X	
Cyperus polystachyos										X				X		
Cyperus rotundus	Nutgrass	*											X	X		
Ficinia nodosa	Knobby Club-rush													X		
Schoenoplectus validus																X
Dietes grandiflora		*								X			X			
Juncus acutus	Sharp Rush	*			X						X				X	
Juncus kraussii	Sea Rush				X					X	X					
Juncus kraussii subsp. australiensis															X	
Lomandra longifolia 'Tanika'		P								X			X			
Lomandra longifolia	Spiny-headed Mat-rush													X		
Dianella caerulea	Blue Flax-lily												X			

Species Name	Common Name	Exotic	Q1	Q2	Q3	Q4	Q5	Q6	Q7	RMS1	RMS2	RMS3	RMS4	RMS5	RMS6	Incidental
Dianella caerulea var. producta								X								
Typha orientalis	Broadleaf Cumbungi									X	X			X		

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APPENDIX B :
Threatened Flora Likelihood of Occurrence

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Table 9 Threatened flora likelihood of occurrence within the subject site

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
Asteraceae	*Senecio spathulatus*	Coast Groundsel	E		3	The species grows on frontal dunes and occurs in Nadgee Nature Reserve (Cape Howe) and between Kurnell in Sydney and Myall Lakes National Park (with a possible occurrence at Cudmirrah). In Victoria there are scattered populations from Wilsons Promontory to the NSW border.	Unlikely to occur. No suitable frontal dune habitat present within the subject site.
Casuarinaceae	*Allocasuarina glareicola*		E	E	0	Primarily restricted to the Richmond (NW Cumberland Plain) district, but with an outlier population found at Voyager Point, Liverpool. Grows in Castlereagh woodland on lateritic soil. Found in open woodland.	Unlikely to occur. No suitable habitat present as the subject site is outside the Cumberland Plain and no lateritic soils are present.
Casuarinaceae	*Allocasuarina portuensis*	Nielsen Park She-oak	E	E	5	The original known habitat of the Neilsen Park She-oak is at Nielsen Park, in Woollahra local government area. There are no plants left at the original site where it was discovered. However, propagation material has been planted successfully at a number of locations at Nielsen Park and other locations in the local area, e.g. Gap Bluff, Hermit Point and Vaucluse House.	Unlikely to occur. Subject site is outside of the known range / replanting locations of this species.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
Doryanthaceae	*Doryanthes palmeri*	Giant Spear Lily	V		2	Occurs on exposed rocky outcrops on infertile soils or on bare rock. Generally found along cliff-tops and on steep cliff-faces in montane heath, in subtropical rainforest, warm temperate rainforest or wet eucalypt forest.	Unlikely to occur. No suitable habitat present.
Ericaceae	*Epacris purpurascens var. purpurascens*		V		1	Found in a range of habitat types, most of which have a strong shale soil influence. Recorded from Gosford in the north, to Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the South.	Unlikely to occur. No suitable habitat present. Soils across open areas have been disturbed due to historical land uses.
Fabaceae (Mimosoideae)	*Acacia prominens*	Gosford Wattle, Hurstville and Kogarah Local Government Areas	EP		1	Grows in open situations on clayey or sandy soils. Occurs at a few sites along the railway line at Penshurst, at Carss Bush Park, Carss Park and there is an unconfirmed siting at Oatley Park, Oatley. This population is disjunct from other populations (Hunter Valley to Gosford region) and at the southern limit of the range of the species.	Unlikely to occur. The species have not been recorded on site and it is unlikely the species to be present in seedbank due to the level of historical disturbance. The species have a disjunct distribution in the local government areas of Hurtsville and Kogarah, where the population is lised as Endangered.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
Fabaceae (Mimosoideae)	*Acacia pubescens*	Downy Wattle	V	V	470	Occurs on alluviums, shales and at the intergrade between shales and sandstones. Occur in open woodland and forest, including Cooks River/Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland.	Unlikely to occur. No suitable habitat within the subject site, which is situated on landfill material and sandy soils. However, fluvial soils is mapped just to the north of the subject site.
Fabaceae (Mimosoideae)	*Acacia terminalis subsp. Eastern Sydney*	Sunshine Wattle	E	E	164	Coastal scrub and dry sclerophyll woodland on sandy soils . Habitat is generally sparse and scattered. Very limited distribution between Botany Bay to the northern foreshore of Port Jackson.	Unlikely to occur due to unsuitable habitat in addition to the history of high disturbance within the subject site.
Fabaceae (Mimosoideae)	*Acacia bynoeana*	Bynoe's Wattle	E	V	0	Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple. Bynoe's wattle is found in central eastern NSW, from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains.	Unlikely to occur due to non-suitable soils and habitat in addition to the history of high disturbance within the subject site.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						It has recently been found in the Colymea and Parma Creek areas west of Nowra.	
Geraniaceae	*Pelargonium Striatellum* *sp.*	Omeo Storksbill	E	E	0	It has a narrow habitat that is usually just above the high-water level of irregularly inundated or ephemeral lakes, in the transition zone between surrounding grasslands or pasture and the wetland or aquatic communities. It sometimes colonises exposed lake beds during dry periods. The extent of habitat at any one site and the persistence of the species is likely be closely related to the combined effects of: - frequency of inundation and the topography of lake bed and shoreline, which maintains a more or less extensive disturbed interzone between grass-dominated communities and sedge-dominated aquatic vegetation; and - past and current grazing regimes and other forms of disturbance. Known from only 4 locations in NSW, with three on lake-beds on the basalt plains of the Monaro and one at Lake Bathurst.	Unlikely to occur. Although wetland and aquatic habitat (e.g. Cooks River bank) could potentially represent suitable habitat for the species, it has a more western distribution.
Lamiaceae	*Prostanthera densa*	Villous Mint-bush	V	V	0	Generally grows in sclerophyll forest and shrubland on coastal headlands and near	Unlikely to occur at the subject site because the

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						coastal ranges, chiefly on sandstone, and rocky slopes near the sea. This species has been recorded from the Currarong area in Jervis Bay, Royal National Park (Marley), Cronulla, Helensburgh and Port Stephens (Nelson Bay). The Sydney and Royal National Park populations were thought possibly extinct, but the species is now known to occur at Bass and Flinders Point in Cronulla.	the site is outside the distribution range where the species naturally occur.
Myrtaceae	*Callistemon linearifolius*	Netted Bottle Brush	V		3	Grows in dry sclerophyll forest on the coast and adjacent ranges. Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. For the Sydney area, recent records are limited to the Hornsby Plateau area near the Hawkesbury River.	Unlikely to occur; no suitable habitat on the subject site. Has not been planted.
Myrtaceae	*Darwinia biflora*			V	0	Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone. Recorded in Ku-ring-gai, Hornsby, Baulkham Hills and Ryde local government areas. The northern, southern, eastern and western limits of the range are at Maroota, North Ryde, Cowan and Kellyville, respectively.	Unlikely to occur at the subject site because there the site is outside the distribution range where the species naturally occur.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
Myrtaceae	*Eucalyptus camfieldii*	Camfield's Stringybark	V	E		Restricted distribution in a narrow band with the most northerly records in the Raymond Terrace area south to Waterfall. Localised and scattered distribution includes sites at Norah Head (Tuggerah Lakes), Peats Ridge, Mt Colah, Elvina Bay Trail (West Head), Terrey Hills, Killara, North Head, Menai, Wattamolla and a few other sites in Royal National Park.	Unlikely to occur at the subject site because there the site is outside the distribution range where the species naturally occur.
Myrtaceae	*Eucalyptus nicholii*	Narrow-leaved Black Peppermint	V	V	6	Typically grows in dry grassy woodland, on shallow soils of slopes and ridges. Found primarily on infertile soils derived from granite or metasedimentary rock. Seedling recruitment is common, even in disturbed soils, if protected from grazing and fire. Tends to grow on lower slopes in the landscape. This species is sparsely distributed but widespread on the New England Tablelands from Nundle to north of Tenterfield, being most common in central portions of its range. Found largely on private property and roadsides, and occasionally in conservation reserves. Planted as urban trees, windbreaks and corridors.	Unlikely to occur at the subject site because there is no suitable habitat and the site is outside the distribution range where the species naturally occur. Has not been planted.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
Myrtaceae	*Eucalyptus scoparia*	Wallangarra White Gum	E	V	3	Found in open eucalypt forest, woodland and heaths on welldrained granite/rhyolite hilltops, slopes and rocky outcrops, typically at high altitudes. At lower elevations can occur in less rocky soils in damp situations.. In NSW it is known from only three locations near Tenterfield, including Bald Rock National Park.	Unlikely to occur at the subject site because there is no suitable habitat and the site is outside the distribution range where the species naturally occur. Has not been planted.
Myrtaceae	*Syzygium paniculatum*	Magenta Lilly Pilly	E	V	172	On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. It is known to occur in the local government areas of Goulburn-Mulwaree, Cooma-Monaro, and Snowy River, but may occur in other areas with suitable habitat; these may include Bombala, Eurobodalla, Palerang, Tumbarumba, Tumut, Upper Lachlan, and Yass Valley local government areas.	No suitable habitat within the subject site and has not been recorded within the study area to date. However, it is a popular horticultural species and is commonly planted in gardens.
Myrtaceae	*Melaleuca biconvexa*	Biconvex Paperbark	V	V	0	It generally grows in damp places, often near streams or lowlying areas on alluvial soils of low slopes or sheltered aspects. Flowering occurs over just 3-4 weeks in September and October. Resprouts following fire. It is is only found in NSW,	Unlikely to occur at the subject site because there is no suitable habitat and the site is outside the distribution range where the species

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						with scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north.	naturally occur. Has not been planted.
Myrtaceae	*Melaleuca deanei*	Deane's Paperbark	V	V	0	Occurs mostly in ridgetop woodland, with only 5% of sites in heath on sandstone. Occurs in two distinct areas, in the Ku-ring-gai/Berowra and Holsworthy/Wedderburn areas respectively. There are also more isolated occurrences at Springwood (in the Blue Mountains), Wollemi National Park, Yalwal (west of Nowra) and Central Coast (Hawkesbury River) areas.	Unlikely to occur at the subject site because there the site is outside the distribution range where the species naturally occur.
Myrtaceae	*Rhodamnia rubescens*	Scrub Turpentine	CE	CE	0	Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils. Occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Populations of *R. rubescens* typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m a.s.l. in areas with rainfall of 1,000-1,600 mm.	No suitable habitat within the subject site and has not been recorded within the subject site to date.
Myrtaceae	*Rhodomyrtus psidioides*	Native Guava	CE	CE	0	Pioneer species found in littoral, warm temperate and subtropical rainforest and	Unlikely to occur at the subject site because

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						wet sclerophyll forest often near creeks and drainage lines. Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines.	there the site is outside the distribution range where the species naturally occur.
Orchidaceae	*Caladenia tessellata*	Thick-lipped Spider Orchid	E	V	0	Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil.	No suitable habitat within the subject site and has not been recorded within the subject site to date.
Orchidaceae	*Calochilus pulchellus*	Pretty Beard Orchid	E	E	0	It is known from the Sydney Basin Bioregion, where a total of less than 30 adult plants have been recorded in three sites over a range of 40 km on the South Coast of NSW, at altitudes from 20-560 m above sea level. All currently known sites are within the Shoalhaven Local Government Area.	Unlikely to occur at the subject site because there the site is outside the distribution range where the species naturally occur.
Orchidaceae	*Cryptostylis hunteriana*	Leafless Tongue Orchid	V	V	0	Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. The larger populations typically occur in woodland dominated by Scribbly Gum (Eucalyptus sclerophylla), Silvertop Ash (E. sieberi), Red	Unlikely to occur at the subject site due to the absence of swamp-heat and woodland habitats, in addition to the large history of disturbance of soils at the site.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						Bloodwood (Corymbia gummifera) and Black Sheoak (Allocasuarina littoralis); appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (C. subulata) and the Tartan Tongue Orchid (C. erecta). Little is known about the ecology of the species; being leafless it is expected to have limited photosynthetic capability and probably depends upon a fungal associate to meet its nutritional requirements from either living or dead organic material It has been recorded from as far north as Gibraltar Range National Park south into Victoria around the coast as far as Orbost. In NSW, it has been recorded at many sites between Batemans Bay and Nowra, at Nelson Bay, Wyee, Washpool National Park, Nowendoc State Forest, Ku-Ring-Gai Chase National Park and Ben Boyd National Park.	
Orchidaceae	*Genoplesium baueri*	Bauer's Orchid	Midge	E	E	5	The species Grows in dry sclerophyll forest and moss gardens over sandstone. It has been recorded from locations between Ulladulla and Port Stephens. Historical	Unlikely to occur within the subject site due to no

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						records in the 1960s included Sydney suburbs including Asquith, Cowan, Gladesville, Longueville and Wahroonga. The species has been recorded at locations now likely to be within Berowra Valley Regional Park, Royal National Park and Lane Cove National Park reserves.	suitable habitat being present.
Orchidaceae	*Pterostylis saxicola*	Sydney Plains Greenhood	E	E	0	Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. It occurs in vegetation communities above the shelves, including sclerophyll forest or woodland on shale/sandstone transition soils or shale soils. Restricted to western Sydney between Freemans Reach in the north and Picton in the south. There are very few known populations and they are all very small and isolated. Only one population occurs within a conservation reserve (Georges River National Park).	Unlikely to occur at the subject site due to the absence of suitable soils and vegetation communities.
Orchidaceae	*Pterostylis sp. Botany Bay (A.Bishop J221/1-13)*	Botany Bay Bearded Orchid	E	E	0	Occupies moist level sites on skeletal sandy soils derived from sandstone. Associated vegetation is coastal heath dominated by Melaleuca nodosa and Baeckea imbricata. Occurs in small	Unlikely to occur at the subject site due to the absence of suitable soils and vegetation communities.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						localised populations, usually in areas within the heath where the canopy allows filtered light to reach the ground. Restricted to the Sydney region where it is known from a small number of sites within Botany Bay National Park on the Kurnell Peninsula. The species was first collected at Maroubra in 1908, although it has not been recorded at Maroubra since that time.	
Orchidaceae	*Rhizanthella slateri*	Eastern Underground Orchid	V	E	0	Habitat requirements are poorly understood and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest. Occurs from south-east Queensland to south-east NSW. In NSW, currently known from fewer than 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra.	Unlikely to occur within the subject site due to its altered nature as an active golf course.
Orchidaceae	*Thelymitra kangaloonica*	Kangaloon Sun Orchid	CE	CE	0	The species is found in swamps in sedgelands over grey silty grey loam soils. It is only known to occur on the southern tablelands of NSW in the Moss Vale /	Unlikely to occur within the subject site due to its location being outside the distribution range of

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						Kangaloon / Fitzroy Falls area at 550-700 m above sea level. It is known to occur at three "Coastal Upland Swamps" that are above the Kangaloon Aquifer.	the species and lack of suitable habitat.
Poaceae	*Deyeuxia appreseusa*		E	E	0	A highly restricted NSW endemic known only from two pre-1942 records in the Sydney area. Was first collected in 1930 at Herne Bay, Saltpan Creek, off the Georges River, south of Bankstown. Was then collected in 1941 from Killara, near Hornsby. Has not been collected since and may now be extinct in the wild due to the level of habitat loss and development that has occurred within these areas.	Unlikely to occur at the subject site because there the site is outside the distribution range where the species naturally occur.
Polygonaceae	*Persicaria elatior*	Tall Notweed	V	V	0	This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance. Tall Knotweed has been recorded in south-eastern NSW (Mt Dromedary (an old record), Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. In northern NSW it is known from Raymond Terrace (near Newcastle) and	Unlikely to occur at the subject site because there the site is outside the distribution range where the species naturally occur.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						the Grafton area (Cherry Tree and Gibberagee State Forests).	
Proteaceae	*Macadamia integrifolia*	Macadamia Nut		V	2	Occurs in a range from central queensland to North Sydney.	Unlikely to occur at the subject site because there the site is outside the distribution range where the species naturally occur.
Proteaceae	*Persoonia hirsuta*	Hairy Geebung	E	E	1	It is found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone. It is usually present as isolated individuals or very small populations. It is probably killed by fire (as other Persoonia species are) but will regenerate from seed. It has a scattered distribution around Sydney. The species is distributed from Singleton in the north, along the east coast to Bargo in the south and the Blue Mountains to the west. It has a large area of occurrence, but occurs in small populations, increasing the species' fragmentation in the landscape.	Unlikely to occur at the subject land due to the history of disturbance and the lack of suitable habitat.
Proteaceae	*Persoonia nutans*	Nodding Geebung	E	E		Northern populations are confined to aeolian and alluvial sediments and occur in a range of sclerophyll forest and woodland	Unlikely to occur at the subject site because there the site is outside

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						vegetation communities, with the majority of individuals occurring within Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland and some in Cooks River / Castlereagh Ironbark Forests. Southern populations also occupy tertiary alluvium, but extend onto shale sandstone transition communities and into Cooks River / Castlereagh Ironbark Forest. Restricted to the Cumberland Plain in western Sydney, between Richmond in the north and Macquarie Fields in the south.	the distribution range where the species naturally occur.
Rutaceae	*Pomaderris brunnea*	Brown Pomaderris	E	V	0	Grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines. Found in a very limited area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. It also occurs near Walcha on the New England tablelands and in far eastern Gippsland in Victoria.	Unlikely to occur at the subject site because there the site is outside the distribution range where the species naturally occur.
Rutaceae	*Pomaderris prunifolia*		EP		1	Known from only three sites within the listed local government areas, at Rydalmere, within Rookwood Cemetery and at The Crest of Bankstown.	Unlikely to occur at the subject site because there the site is outside the distribution range

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
							where the species naturally occur.
Rutaceae	*Asterolasia elegans*		E	E	0	Occurs on Hawkesbury sandstone in sheltered forests on mid- to lower slopes and valleys north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby local government areas. Also likely to occur in the western part of Gosford local government area. Known from only seven populations, only one of which is wholly within a conservation reserve.	Unlikely to occur at the subject site because there the site is outside the distribution range where the species naturally occur.
Santalaceae	*Thesium australe*	Austral Toadflax	V	V	0	Occurs in grassland or grassy woodland. Often found in damp sites in association with Kangaroo Grass (Themeda triandra). A root parasite that takes water and some nutrient from other plants, especially Kangaroo Grass.	Unlikely to occur. The species have not been recorded on site and it is unlikely the species to be present in seedbank due to the level of historical disturbance on the subject site.
Thymelaeaceae	*Pimelea curviflora var. curviflora*		V	V	0	Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Also recorded in Illawarra Lowland Grassy Woodland habitat at Albion Park on the Illawaraa	Unlikely to occur at the subject site due to no suitable soils and habitat being present.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						coastal plain. Confined to the coastal area of the Sydney and Illawarra regions. Populations are known between northern Sydney and Maroota in the north-west. New population discovered at Croom Reserve near Albion Park in Shellharbour LGA in August 2011. Formerly recorded around the Parramatta River and Port Jackson region including Five Dock, Bellevue Hill and Manly.	
Thymelaeaceae	*Pimelea spicata*	Spiked Rice-flower	E	E	0	In both the Cumberland Plain and Illawarra environments this species is found on well-structured clay soils. On the Cumberland Plain sites it is associated with Grey Box communities (particularly Cumberland Plain Woodland variants and Moist Shale Woodland) and in areas of ironbark. In the coastal Illawarra it occurs commonly in Coast Banksia open woodland with a better developed shrub and grass understorey. Coastal headlands and hilltops are the favoured sites. Once widespread on the Cumberland Plain, the Spiked Rice-flower occurs in two disjunct areas; the Cumberland Plain (Marayong and Prospect Reservoir south to Narellan	Unlikely to occur at the subject site due to no suitable soils and habitat being present.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						and Douglas Park) and the Illawarra (Landsdowne to Shellharbour to northern Kiama).	

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APPENDIX C :
Fauna Species List

Table 10 Fauna species recorded on the subject site

Common Name	Scientific Name	Introduced
Amphibia		
Common Eastern Froglet	*Crinia signifera*	
Eastern Sedge Frog	*Litoria fallax*	
Green and Golden Bell Frog	*Litoria aurea*	
Peron's Tree Frog	*Litoria peronii*	
Striped Marsh Frog	*Limnodynastes peronii*	
Aves		
Australasian Figbird	*Sphecotheres vieilloti*	
Australasian Grebe	*Tachybaptus novaehollandiae*	
Australian Magpie	*Cracticus tibicen*	
Australian Raven	*Corvus coronoides*	
Australian White Ibis	*Threskiornis molucca*	
Australian Wood Duck	*Chenonetta jubata*	
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	
Chestnut Teal	*Anas castanea*	
Common Myna	*Sturnus tristis*	x
Common Starling	*Sturnus vulgaris*	x
Crested Pigeon	*Ocyphaps lophotes*	
Dusky Moorhen	*Gallinula tenebrosa*	
Grey Butcherbird	*Cracticus torquatus*	
Hoary-headed Grebe	*Poliocephalus poliocephalus*	
Little Black Cormorant	*Phalacrocorax sulcirostris*	
Little Corella	*Cacatua sanguinea*	
Magpie-lark	*Grallina cyanoleuca*	
Masked Lapwing	*Vanellus miles*	
Noisy Miner	*Manorina melanocephala*	
Pacific Black Duck	*Anas superciliosa*	
Pilgrim Goose	*Anser Anser Domesticus*	x
Rainbow Lorikeet	*Trichoglossus haematodus*	
Red-rumped Parrot	*Psephotus haematonotus*	
Red-whiskered Bulbul	*Pycnonotus jocosus*	x
Silver Gull	*Chroicocephalus novaehollandiae*	
Superb Fairy-wren	*Malurus cyaneus*	
Welcome Swallow	*Hirundo neoxena*	

Common Name	Scientific Name	Introduced
White-faced Heron	*Egretta novaehollandiae*	
Willie Wagtail	*Rhipidura leucophrys*	
Fishes		
Long -finned Eel	*Anguilla australis*	
Long -finned Eel	*Anguila reinhardtii*	
Mosquito Fish	*Gambusia holbrooki*	x
Sea Mullet	*Mugil cephalus*	
Mammalia		
Black Rat	*Rattus rattus*	x
Eastern Bent-wing Bat	*Miniopterus schreibersii oceanensis*	
Eastern Free-tail Bat	*Mormopterus ridei*	
European Red Fox	*Vulpes vulpes*	x
Gould's Wattled Bat	*Chalinolobus gouldii*	
Grey-headed Flying-fox	*Pteropus poliocephalus*	
White-striped Free-tailed Bat	*Austronomus australis*	
Reptilia		
Eastern Long-necked Turtle	*Chelodina longicollis*	
Eastern Water Skink	*Eulamprus quoyii*	

APPENDIX D :

Threatened Fauna Likelihood of Occurrence

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Table 11 Threatened fauna likelihood of occurrence within the subject site

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
Amphibia							
Hylidae	*Litoria aurea*	Green and Golden Bell Frog	E	V	821	Freshwater marshes, dams or streams with Typha (bullrushes) or Elaeocharis (spikerushes). In NSW, the Green and Golden Bell Frog commonly occupy disturbed habitats and can be found in a range of water bodies except fast flowing streams. Favourable breeding habitat includes water bodies that are shallow, still or slow flowing, ephemeral and/or widely fluctuating, unpolluted, unshaded, with aquatic plants and free of Mosquito Fish (Gambusia holbrooki) and other predatory fish, with terrestrial habitats that consist of grassy areas and vegetation no higher than woodlands, and a range of diurnal shelter sites.	Recorded within the Cooks Cove site, which encompasses the former Southern and Northern Precincts during the previous detailed studies by Cumberland Ecology (2006, 2010) and in 2020 surveys. Previously found on the Kogarah Golf Course. The key breeding habitat for Green and Golden Bell Frog consists primarily of the RTA breeding ponds, which were established for a previous RTA development approval.. Although a couple of ponds on the existing Kogarah Golf Course are reported to have provided breeding habitat in the past (Eco Logical Australia, 2015), it has been acknowledged that breeding events in these latter ponds are rare and unlikely, due to

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
							the presence of Mosquito Fish (Gambusia holbrooki). The surrounding grassed areas, fringing vegetation around golf ponds and any ephemeral wet areas including drainages are present within the Cooks Cove site, particularly on the subject site; these provide habitat for foraging and dispersal from the RTA breeding ponds and are critical in maintaining the breeding population.
Hylidae	*Litoria raniformis*	Growling Grass Frog	E	V	0	Occurs in or around permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and river valleys.	Unlikely to occur. No suitable habitat present within the subject site.
Myobatrachidae	*Crinia tinnula*	Wallum Froglet	V		5	Acid paperbark swamps and sedge swamps of the coastal 'wallum' country, typically occuring in sedgelands and wet heathlands. Breeds in swamps with permanent	Unlikely to occur. No suitable habitat present within the subject site.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						water as well as shallow ephemeral pools and drainage ditches.	
Myobatrachidae	*Heleioporus australiacus*	Giant Burrowing Frog	V	V	0	Occurs in heath, woodland and open dry sclerophyll forst on a varitey of soil types. Breeding habitat for this species usually contains soaks or pools within first of second order streams.	Unlikely to occur. No suitable habitat present within the subject site.
Myobatrachidae	*Mixophyes balbus*	Stuttering Frog	E	V	0	Typically found in association with permanent streams through temperate and sub-tropical rainforest, and wet sclerophyll forest. It is rarely found in dry, open, tableland, riparian vegetation, and moist gullies in dry forest.	Unlikely to occur. No suitable habitat present within the subject site.
Myobatrachidae	*Pseudophryne australis*	Red-crowned Toadlet	V		1	Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings. Shelters under rocks and amongst masses of dense vegetation or thick piles of leaf litter. Breeding congregations occur in dense vegetation and debris beside ephemeral creeks and gutters.	Unlikely to occur. No suitable habitat present within the subject site.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
Aves							
Accipitridae	*Circus assimilis*	Spotted Harrier	V		2	Occurs throughout mainland Australia except in densely forested or wooded habitats of the coast, escarpment, and ranges. It inhabits open grassy woodland, shrubland, and grassland. It nests in trees and preys on terrestrial mammals, birds, and reptiles, and will occasionally consume carrion.	Unlikely to occur. The species tends to occur in drier habitats further inland.
Accipitridae	*Erythrotriorchis radiatus*	Red Goshawk	CE	V	0	Distributed sparsely through northern and eastern Australia, from the western Kimberley Division of northern Western Australia to north-eastern Queensland and south to far north-eastern NSW, and with scattered records in central Australia. The species is very rare in NSW, extending south to about 30°S, with most records north of this, in the Clarence River Catchment, and a few around the lower Richmond and Tweed Rivers.	Unlikely to occur. This species is very rare in NSW and extends primarily to far northern NSW.
Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	V	C	96	Found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands. The	Possible but unlikely to occur. This species has been recorded within Botany Bay. As this species is a migratory species with a wide range, this

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						habitats occupied by the sea-eagle are characterised by the presence of large areas of open water.	species may pass near the subject site on occasion as part of a wider foraging range, particularly along Cooks River. Unlikely to utilise the subject site itself. No nests were recorded on the subject site during recent surveys.
Accipitridae	*Hieraaetus morphnoides*	Little Eagle	V		3	Occupies habitats rich in prey (birds, reptiles and mammals) within open eucalypt forest, woodland, or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a tall living tree within a remnant patch.	Possible but unlikely to occur. Although it is a highly mobile, aerial species, the habitat on the subject site is highly marginal and disturbed and the species is not commonly known from the locality.
Accipitridae	*Lophoictinia isura*	Square-tailed Kite	V		8	Found in a variety of timbered habitats indluing dry woodlands and open forests. It is a specialist hunter preying on passerine birds, especially honeyeaters and targets predominately nestlings and insects occuring in the tree canopy. It nests in tree forks or on large horizontal tree	Possible but unlikely to occur. Although it is a highly mobile, aerial species, the habitat on the subject site is highly marginal and disturbed and the species is not commonly known from the locality.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						limbs located mostly along or near watercourses.	
Accipitridae	*Pandion cristatus*	Eastern Osprey	V		51	Found at littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands.	Possible but unlikely to occur. This species has been recorded within Botany Bay. As this species is highly mobile, this species may pass over the subject site on occasion as part of a wider foraging range, particularly along Cooks River but would unlikely utilise the subject site itself. No nests were recorded on the subject site during recent surveys.
Anatidae	*Oxyura australis*	Blue-billed Duck	V		1	Prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. This species is completely aquatic.	Unlikely to occur. No suitable habitat present within the subject site.
Anatidae	*Stictonetta naevosa*	Freckled Duck	V		1	This species occurs primarily in south-eastern and south-western Australia and occurs as a vagrant elsewhere. It breeds in large, temporary swamps created during flood events in the Bulloo and Lake Eyres basins and along the Murray-Darling river system.	Unlikely to occur. No suitable habitat present within the subject site.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						During inland droughts the species disperses to wetlands in the Murray River basin, and occasionally to coastal areas. The species prefers permanent freshwater swamps and creeks heavy with shrub, sedge, and rush growth. It rests in dense cover during the day, usually in deep water and feeds at dusk and sawn on algae, seeds, and vegetative parts of aquatic sedges and grasses. It nests generally during October to December in dense vegetation near to the water level.	
Anseranatidae	*Anseranas semipalmata*	Magpie Goose	V		9	Species occurs in shallow wetlands with dense growth or rushes or sedges. Nesting occurs in trees over deep water. More common in the Australian northern tropics.	Unlikely to occur. No suitable habitat present within the subject site and the species is lesson common in the Sydney region.
Apodidae	*Apus pacificus*	Fork-tailed Swift		Migr.	4	Forages aerially over a variety of habitats usually over coastal and mountain areas with a preference for wooded areas.	Potential to occur. Highly mobile, aerial species that may pass over the subject site but unlikely to utilise it directly.
Apodidae	*Hirundapus caudacutus*	White-throated Needletail		V, Migr.	21	Almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. Occur over most	Potential to occur. Highly mobile, aerial species that may pass over the subject

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						types of habitat, particularly above wooded areas including open forest and rainforest, between trees or in clearings and below the canopy.	site but unlikely to utilise it directly.
Ardeidae	*Botaurus poiciloptilus*	Australasian Bittern	E	E	3	Permanent freshwater wetlands with tall, dense vegetation, particularly bulrushes and spikerushes.	Unlikely to occur. No suitable habitat present within the subject site. Recorded by Biosphere Environmental Consultants (2000) in the Eve Street Wetland and Marsh Street Wetland, outside of the subject site. The habitat in which this species previously occurred has become less suitable or unsuitable due to weed invasion, the encroachment of mangroves (in the case of Spring Street wetland), planted vegetation at the perimeters and the presence of M5 motorway (in the case of Eve Street wetland). Given the absence of recent records of this species and the reduction in habitat value since it was recorded, the species has

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
							been assessed as having a low likelihood of occurrence and would unlikely occur within the subject site.
Ardeidae	*Egretta sacra*	Eastern Reef Egret		C	1	Inhabits beaches, rocky shores, tidal rivers and inlets, mangroves, and exposed coral reefs.	Unlikely to occur. No suitable habitat present within the subject site.
Ardeidae	*Ixobrychus flavicollis*	Black Bittern	V		4	Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves. Has a wide distribution, from southern NSW north to Cape York and along the north coast to the Kimberley region.	Possible but unlikely to occur. May occasionally utilise the wider study area, outside of the subject site, where areas of mangroves and permanent flooded areas occur. But would unlikely utilise the subject site itself. The species has not been recorded within the subject site during surveys.
Artamidae	*Artamus cyanopterus cyanopterus*	Dusky Woodswallow	V		5	Found in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations.	Unlikely to occur. No suitable habitat present within the subject site.
Burhinidae	*Burhinus grallarius*	Bush Stone-curlew	E		8	Lives in open forest and woodlands with a sparse, grassy ground layer, and fallen timber. It feeds on insects and small insects and vertebrates including	Unlikely to occur. No suitable habitat present within the subject site.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						frogs, lizards, and snakes. Nesting is undertaken in a scrape or small bare patch.	
Burhinidae	*Esacus magnirostris*	Beach Stone-curlew	CE		2	Occurs exclusively along the coast, on a wide range of beaches, islands, reefs and in estuaries, and may often be seen at the edges of or near mangroves.	Possible but unlikely to occur. Highly marginal suitable habitat present within the subject site within the mangrove area, but the species is not commonly recorded within the subject site.
Burramyidae	*Cercartetus nanus*	Eastern Pygmy-possum	V		2	Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. Found in south-eastern Australia, from southern Queensland to eastern South Australia and in Tasmania. In NSW it extends from the coast inland as far as the Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes.	Unlikely to occur. No suitable habitat present within the subject site.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
Cacatuidae	*Callocephalon fimbriatum*	Gang-gang Cockatoo	V	E	4	In summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. In NSW, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes.	Possible but unlikely to occur. Some marginal suitable habitat present within the subject site as the species can utilise urban areas, but the species is not commonly recorded within the locality.
Cacatuidae	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V	V	7	Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of she-oak species, particularly Black She-oak (Allocasuarina littoralis), Forest She-oak (A. torulosa) or Drooping She-oak (A. verticillata) occur.	Unlikely to occur. No suitable habitat present within the subject site as it is too disturbed and the species tends to occur in larger tracts of intact forest where extensive clearing has not occurred.
Cacatuidae	*Lophochroa leadbeateri*	Major Mitchell's Cockatoo	V		3	Inhabits a wide range of treed and treeless inland habitats, always within easy reach of water.	Unlikely to occur. The species tends to occur in drier habitats further inland.
Charadriidae	*Charadrius bicinctus*	Double-banded Plover		M	0	Found on littoral, estuarine and fresh or saline terrestrial wetlands and also saltmarsh, grasslands and pasture.	Possible but unlikely. Highly marginal potential habitat for

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
							the species occurs on and surrounding the subject site.
Charadriidae	*Charadrius ruficapillus*	Red-capped Plover		M	0	Found in wetlands, especially in arid areas, and prefers saline and brackish waters.	Unlikely to occur. No suitable habitat present within the subject site.
Charadriidae	*Charadrius leschenaultii*	Greater Sand-plover	V	V, Migr.	6	Sheltered sandy or muddy beaches or estuaries with large intertidal mudflats or sandbanks.	Unlikely to occur. No suitable habitat present within the subject site.
Charadriidae	*Charadrius mongolus*	Lesser Sand-plover	V	E, Migr.	12	Beaches of sheltered bays, harbours and estuaries with large intertidal sand/mudflats.	Unlikely to occur. No suitable habitat present within the subject site.
Charadriidae	*Charadrius veredus*	Oriental Plover		Migr.	2	Occurs generally inland within open grasslands in arid and semi-arid zones; and less often in estuarine or littoral environments. Prefers flat inland plains with sparse vegetation.	Unlikely to occur. No suitable habitat present within the subject site.
Charadriidae	*Pluvialis fulva*	Pacific Golden Plover		Migr.	120	Occurs in coastal habitats and occasionally around inland wetlands. Inland areas usually consist of wetlands with muddy margins and short emergent vegetation.	Unlikely to occur. No suitable habitat present within the subject site.
Charadriidae	*Pluvialis squatarola*	Grey Plover		Migr.	15	In non-breeding grounds in Australia, Grey Plovers occur almost entirely in coastal areas, where they usually inhabit sheltered embayments,	Unlikely to occur. No suitable habitat present within the subject site.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						estuaries and lagoons with mudflats and sandflats, and occasionally on rocky coasts with wave-cut platforms or reef-flats, or on reefs within muddy lagoons. They also occur around terrestrial wetlands such as near-coastal lakes and swamps, or salt-lakes	
Ciconiidae	*Ephippiorhynchus asiaticus*	Black-necked Stork	E		1	Occurs in floodplain wetlands of major coastal rivers along with minor floodplains, coastal sandplain wetlands and estuaries. Species builds nest in high in trees close to water.	Unlikely to occur. No suitable habitat present within the subject site.
Columbidae	*Ptilinopus superbus*	Superb Fruit-Dove	V		10	Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees.	Unlikely to occur. No suitable habitat present within the subject site.
Cuculidae	*Cuculus optatus*	Oriental Cuckoo		Mar.	4	Inhabits forest and woodland.	Unlikely to occur. No suitable habitat present within the subject site.
Dasyornithidae	*Dasyornis brachypterus*	Eastern Bristlebird	E	E	0	Habitat for central and southern populations is characterised by dense, low vegetation including heath and open woodland with a heathy	Unlikely to occur. No suitable habitat present within the subject site.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						understorey. In northern NSW the habitat occurs in open forest with dense tussocky grass understorey and sparse mid-storey near rainforest ecotone; all of these vegetation types are fire prone.	
Estrildidae	*Neochmia ruficauda*	Star Finch	Ext.	E	1	Currently only known from Queensland, with NSW populations presumed extinct. Found in grasslands and grassy woodlands that are located close to bodies of fresh water, and can also occur in cleared or suburban areas such as along roadsides and in towns.	Unlikely to occur. No suitable habitat present within the subject site and the species is currently only known from Queensland.
Estrildidae	*Stagonopleura guttata*	Diamond Firetail	V		3	Occurs in grassy eucalypt woodland, icluding Box-Gum Woodlands and Snow Gum Eucalyptus pauciflora Woodlands, open forest and riparian areas. Uncommon in coastal areas.	Unlikely to occur. No suitable habitat present within the subject site.
Falconidae	*Falco hypoleucos*	Grey Falcon	V	V		Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast.	Unlikely to occur. No suitable habitat present within the subject site.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
Haematopodidae	*Haematopus fuliginosus*	Sooty Oystercatcher	V		36	Rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries.	Unlikely to occur. No suitable habitat present within the subject site.
Haematopodidae	*Haematopus longirostris*	Pied Oystercatcher	E		1015	Intertidal flats of inlets and bays, open beaches and sandbanks.	Unlikely to occur. No suitable habitat present within the subject site.
Laridae	*Anous stolidus*	Common Noddy		Migr.	0	Pelagic habitats and during breeding occurs on or near islands, on rocky islets and stacks with precipitous cliffs, or on shoals or cays of coral or sand.	Unlikely to occur. No suitable habitat present within the subject site.
Laridae	*Sternula nereis nereis*	Fairy Tern		V	0	Marine, pelagic and coastal habitats.	Unlikely to occur. No suitable habitat present within the subject site.
Laridae	*Chlidonias leucopterus*	White-winged Black Tern		Migr.	3	Found in coastal or sub-coastal wetlands including tidal estuaries, lagoons, grassy swamps, and sewage ponds.	Unlikely to occur. No suitable habitat present within the subject site.
Laridae	*Gygis alba*	White Tern	V		1	Rare occurrences to the east coast from Norfolk and Lord Howe Island.	Unlikely to occur. No suitable habitat present within the subject site.
Laridae	*Hydroprogne caspia*	Caspian Tern		Migr.	120	Prefers sheltered coastal emabyments but is known to occur in near-coastal or inland terrestrial wetlands. Builds nests in open areas or areas with low vegetation.	Unlikely to occur. No suitable habitat present within the subject site.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
Laridae	*Onychoprion fuscata*	Sooty Tern	V		1	Common on cays in north of Australia.	Unlikely to occur. No suitable habitat present within the subject site.
Laridae	*Procelsterna cerulea*	Grey Ternlet	V		1	Rare occurrences to the east coast from Norfolk and Lord Howe Island.	Unlikely to occur. No suitable habitat present within the subject site.
Laridae	*Sterna hirundo*	Common Tern		Migr.	56	Marine, pelagic and coastal habitats.	Unlikely to occur. No suitable habitat present within the subject site.
Laridae	*Sternula albifrons*	Little Tern	E	Migr.	1777	Occurs in sheltered coastal environments. Nests in colonies in low dunes.	Unlikely to occur. No suitable habitat present within the subject site.
Meliphagidae	*Grantiella picta*	Painted Honeyeater	V	V	0	Occurs in Boree, Brigalow and Box-Gum Woodlands and Box-Ironbarks. Feeds primarily on mistletoe fruit and insects.	Unlikely to occur. No suitable habitat present within the subject site.
Meliphagidae	*Anthochaera phrygia*	Regent Honeyeater	CE	CE	2	Inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. The Regent Honeyeater is a generalist forager, which mainly	Unlikely to occur. No suitable habitat present within the subject site.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						feeds on the nectar from a wide range of eucalypts and mistletoes.	
bittMeliphagidae	*Epthianura albifrons*	White-fronted Chat	V		63	This is a gregarious species generally found foraging on bare or grassy ground in wetland areas, alone or in pairs. They feed on insects, mainly flies and beetle caught on the ground or close to. It occupies foothills and slopes up to 1000 m ASL, though in coastal areas is predominately found in areas of salt marsh, and occasionally in low shrubs bordering wetland areas.	Unlikely to occur. No suitable habitat present within the subject site.
Meliphagidae	*Epthianura albifrons*	White-fronted Chat population in the Sydney Metropolitan Catchment Management Area	EP,V		63	Regularly observed in the saltmarsh of Newington Nature Reserve (with occasional sightings from other parts of Sydney Olympic Park and in grassland on the northern bank of the Parramatta River). Current estimates suggest this population consists of 8 individuals.	Unlikely to occur. No suitable habitat present within the subject site.
Monarchidae	*Monarcha melanopsis*	Black-faced Monarch		M	0	Wetter, denser forest, often at high elevations.	Unlikely to occur. No suitable habitat present on the subject site.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
Monarchidae	*Symposiachrus trivirgatus*	Spectacled Monarch		M	0	Prefers thick understorey in rainforests, wet gullies and waterside vegetation, as well as mangroves.	Unlikely to occur. Highly marginal suitable habitat present on the subject site in the south where the mangrove is present.
Monarchidae	*Myiagra cyanoleuca*	Satin Flycatcher		M	0	Found in rainforest, dense wet eucalypt and monsoon forests, paperbark and mangrove swamps and riverside vegetation.	Unlikely to occur. Highly marginal suitable habitat present on the subject site in the south where the mangrove is present.
Motacillidae	*Motacilla flava*	Yellow Wagtail		Migr.	0	Prefers moist areas, such as the edges of sewage works and exposed mudbanks.	Unlikely to occur. No suitable habitat present on the subject site.
Petroicidae	*Petroica boodang*	Scarlet Robin	V		2	Occurs in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Habitat usually contains abundant logs and fallen timber: these are important components of its habitat. Nests are often found in a dead branch in a live tree, or in a dead tree or shrub.	Unlikely to occur. No suitable habitat present on the subject site.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
Petroicidae	*Petroica phoenicea*	Flame Robin	V			Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys. The Flame Robin is endemic to south eastern Australia, and ranges from near the Queensland border to south east South Australia and also in Tasmania. I	Unlikely to occur. No suitable habitat present on the subject site.
Psittacidae	*Lathamus discolor*	Swift Parrot	E	CE	8	In NSW mostly occurs on the coast and south west slopes. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Eucalyptus robusta, Corymbia maculata, C. gummifera, E. sideroxylon, and E. albens. Breeds in Tasmania in spring and summer.	Unlikely to occur. No suitable habitat present on the subject site.
Psittacidae	*Glossopsitta pusilla*	Little Lorikeet	V		7	Forages primarily in the canopy of open *Eucalyptus* forest and woodland, yet also finds food in *Angophora, Melaleuca* and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence	Unlikely to occur. No suitable habitat present on the subject site.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						greater productivity. Distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the species' core habitat, with lorikeets found westward as far as Dubbo and Albury. Nomadic movements are common, influenced by season and food availability, although some areas retain residents for much of the year and 'locally nomadic' movements are suspected of breeding pairs.	
Psittacidae	*Neophema chrysogaster*	Orange-bellied Parrot	CE	CE	1	Generally found south of NSW in saltmarshes dominated by Beaded Glasswort, Southern Seaheath and Shrubby Glasswort. Breeds in Tasmania.	Unlikely to occur. No suitable habitat present on the subject site.
Psittacidae	*Neophema pulchella*	Turquoise Parrot	V		2	Found at the edges of eucalypt woodland adjacent to clearings, timbered ridges and creeks in farmland. Associated with coastal scrubland, open forest and timbered grassland. Nests in hollow-bearing trees, logs or posts.	Unlikely to occur. No suitable habitat present on the subject site.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
Psittacidae	*Pezoporus wallicus wallicus*	Eastern Ground Parrot	V		2	Occurs in high rainfall coastal and near coastal low heathlands and sedgelands, generally below one metre in height and very dense (up to 90% projected foliage cover). Builds a nest within dense vegetation.	Unlikely to occur. No suitable habitat present on the subject site.
Psittacidae	*Polytelis swainsonii*	Superb Parrot	V	V	1	Occurs in Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest.	Unlikely to occur. No suitable habitat present on the subject site.
Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt		Mar.	0	Prefer freshwater and saltwater marshes, mudflats, and the shallow edges of lakes and rivers.	Unlikely to occur. No suitable habitat present on the subject site.
Recurvirostridae	*Recurvirostra novaehollandiae*	Red-necked Avocet		Mar.	0	Found in large shallow freshwater or saltwater wetlands and estuarine mudflats.	Unlikely to occur. No suitable habitat present on the subject site.
Rhipiduridae	*Rhipidura rufifrons*	Rufous Fantail		Mar.	0	Inhabits rainforest, dense wet forests, swamp woodlands and mangroves, preferring deep shade, and is often seen close to the ground.	Unlikely to occur. No suitable habitat present on the subject site.
Rostratulidae	*Rostratula australis*	Australian Painted Snipe	E	E	1	The Australian Painted Snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged	Unlikely to occur. No suitable habitat present on the subject site.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum Muehlenbeckia or canegrass or sometimes tea-tree (Melaleuca).	
Scolopacidae	*Calidris subminuta*	Long-toed Stint		Migr.	1	Scarce visitor from Northern Hemisphere, occurring at freshwater and brackish lakes and swamps.	Unlikely to occur. No suitable habitat present on the subject site.
Scolopacidae	*Gallinago megala*	Swinhoe's Snipe		Migr.	0	Found at the edges of wetlands, such as wet paddy fields, swamps and freshwater streams.	Unlikely to occur. No suitable habitat present on the subject site.
Scolopacidae	*Gallinago stenura*	Pin-tailed Snipe		Migr.	0	Occurs most often in or at the edges of shallow freshwater swamps, ponds and lakes with emergent, sparse to dense cover of grass/sedge or other vegetation.	Unlikely to occur. No suitable habitat present on the subject site.
Scolopacidae	*Numenius minutus*	Little Curlew		Migr.	1	More heavily distributed along coastal regions north of Sydney. Found feeding in short, dry grassland and sedgeland, including dry floodplains and blacksoil plains, which have scattered, shallow freshwater pools or areas seasonally inundated. Open	Unlikely to occur. No suitable habitat present on the subject site.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						woodlands with a grassy or burnt understorey, dry saltmarshes, coastal swamps, mudflats or sandflats of estuaries or beaches on sheltered coasts, mown lawns, gardens, recreational areas, ovals, racecourses and verges of roads and airstrips are also used.	
Scolopacidae	*Philomachus pugnax*	Ruff		Migr.	0	Found on generally fresh, brackish of saline wetlands with exposed mudflats at the edges.	Unlikely to occur. No suitable habitat present on the subject site.
Scolopacidae	*Tringa nebularia*	Common Greenshank		Migr.	0	Occurs in a wide variety of inland wetlands and sheltered coastal areas. Species does not breed in Australia.	Unlikely to occur. No suitable habitat present on the subject site.
Scolopacidae	*Actitis hypoleucos*	Common Sandpiper		Migr.	15	Inhabits coastal or inland wetlands, both saline or fresh. It is more commonly found on muddy edges or rocky shores.	Unlikely to occur. No suitable habitat present on the subject site.
Scolopacidae	*Arenaria interpres*	Ruddy Turnstone		Migr.	107	Mainly inhabits exposed rocks or reefs, often with shallow pools, and on beaches.	Unlikely to occur. No suitable habitat present on the subject site.
Scolopacidae	*Calidris acuminata*	Sharp-tailed Sandpiper		Migr.	145	Prefers the grassy edges of shallow inland freshwater wetlands, but also occurs at other habitats including	Possible but unlikely to occur. Highly marginal suitable habitat present on the subject

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						mangroves, beaches, mudflats and sewage farms.	site within the mangrove area in the south.
Scolopacidae	*Calidris alba*	Sanderling	V	Migr.	8	Coastal, near reefs and inlets, along tidal mudflats.	Unlikely to occur. No suitable habitat present on the subject site.
Scolopacidae	*Calidris canutus*	Red Knot		E, Migr.	61	Found on the coast in sandy estuaries with tidal mudflats.	Unlikely to occur. No suitable habitat present on the subject site.
Scolopacidae	*Calidris ferruginea*	Curlew Sandpiper	E	CE, Migr.	336	Inhabits intertidal mudflats of estuaries, lagoons, mangroves, as well as beaches, rocky shores and around lakes, dams and floodwaters.	Possible but unlikely to occur. Highly marginal suitable habitat present on the subject site within the mangrove area in the south.
Scolopacidae	*Calidris melanotos*	Pectoral Sandpiper		Migr.	2	Species prefers shallow fresh to saline wetlands and is known to utilise lagoons, estuaries, bays, swamps, lakes, inundated grasslands and other waterbodies. Species does not breed in Australia.	Unlikely to occur. Highly marginal suitable habitat present on the subject site with presence of other waterbodies but species prefers wetlands.
Scolopacidae	*Calidris ruficollis*	Red-necked Stint		Migr.	266	Species occurs in coastal areas including sheltered inlets, bays, lagoons, mudflats, shallow wetlands, swamps and other waterbodies. Species roosts in primarily near	Unlikely to occur. No suitable habitat present on the subject site as species mostly forages on bare wet mud at intertidal flats.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						waterbodies listed above, but also recorded at inland claypans.	
Scolopacidae	*Calidris tenuirostris*	Great Knot	V	CE, Migr.	30	Occurs at intertidal mudflats or sandflats.	Unlikely to occur. No suitable habitat present on the subject site as species mostly forages on bare wet mud at intertidal flats.
Scolopacidae	*Gallinago hardwickii*	Latham's Snipe		Migr.	43	Inhabit open, freshwater wetlands with low, dense vegetation.	Unlikely to occur. No suitable habitat present on the subject site.
Scolopacidae	*Limicola falcinellus*	Broad-billed Sandpiper	V	Migr.	9	Estuarine sandflats and mudflats, harbours, lagoons, saltmarshes.	Unlikely to occur. No suitable habitat present on the subject site.
Scolopacidae	*Limosa lapponica*	Bar-tailed Godwit		Migr.	1376	Found mainly in coastal habitats including large intertidal sandflats, estuaries, bays and lagoons. Often occurs at seagrass and sometimes in nearby saltmarsh.	Unlikely to occur. No suitable habitat present on the subject site.
Scolopacidae	*Limosa lapponica baueri*	Bar-tailed Godwit	V	Migr.	1	Found mainly in coastal habitats including large intertidal sandflats, estuaries, bays and lagoons. Often occurs at seagrass and sometimes in nearby saltmarsh.	Unlikely to occur. No suitable habitat present on the subject site.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
Scolopacidae	*Limosa limosa*	Black-tailed Godwit	V	Migr.	16	Sheltered bays, estuaries and lagoons with large intertidal mudflats.	Unlikely to occur. No suitable habitat present on the subject site.
Scolopacidae	*Numenius madagascariensis*	Eastern Curlew		CE, Migr.	655	Prefers sheltered coasts, especially estuaries, bays, harbours, inlets and lagoons. Also known to occur in sewage farms, wetlands and mangroves. Species roosts on sandy spits and in low Saltmarsh or mangroves.	Possible but unlikely to occur. Highly marginal suitable habitat present on the subject site within the mangrove area in the south.
Scolopacidae	*Numenius phaeopus*	Whimbrel		Migr.	277	Occurs primarily in intertidal mudflats or sheltered coasts, but also occurs in sheltered coastal areas and saline or brackish lakes near the coast. Nesting usually occurs in mangroves and tall coastal trees.	Unlikely to occur. No suitable habitat present on the subject site.
Scolopacidae	*Tringa brevipes*	Grey-tailed Tattler		Migr.	186	Found on sheltered coasts with reefs and rock platforms or with intertidal mudflats.	Unlikely to occur. No suitable habitat present on the subject site.
Scolopacidae	*Tringa glareola*	Wood Sandpiper		Migr.	3	Occurs in well-vegetated, shallow, freshwater wetlands that are contain emergent, aquatic plants or grass, and are dominated by taller fringing vegetation, such as dense stands of rushes or reeds, shrubs, or dead or live	Unlikely to occur. No suitable habitat present on the subject site.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						trees, especially Melaleuca and River Red Gums Eucalyptus camaldulensis and often with fallen timber. Also recorded in grasslands, short herbage or wooded floodplains, where floodwaters are temporary or receding, and irrigated crops.	
Scolopacidae	*Tringa incana*	Wandering Tattler		Migr.	1	Found on rocky coasts with reefs and platforms, points, spits, piers, offshore islands and shingle beaches or beds.	Unlikely to occur. No suitable habitat present on the subject site.
Scolopacidae	*Tringa stagnatilis*	Marsh Sandpiper		Migr.	1	Inhabits fresh or brackish wetlands such as rivers, water meadows, sewage farms, drains, lagoons and swamps.	Unlikely to occur. No suitable habitat present on the subject site.
Scolopacidae	*Xenus cinereus*	Terek Sandpiper	V	Migr.	51	Coastal mudflats, lagoons, creeks. Favours mud/sandbanks located near mangroves.	Unlikely to occur. No suitable habitat present on the subject site.
Strigidae	*Ninox strenua*	Powerful Owl	V		504	The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The species requires large tracts of forest or woodland to breed and relys on large hollows in trees. The species preys on medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar	Potential to occur. Known to utilise fragmented landscapes, may utilise the subject site as part of a larger foraging area.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						Glider. Powerful Owl is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains suggesting occupancy prior to land clearing.	
Tytonidae	*Tyto novaehollandiae*	Masked Owl	V		4	Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats.	Unlikely to occur. No suitable habitat present on the subject site.
Mammalia							
Dasyuridae	*Dasyurus maculatus*	Spotted-tailed Quoll	V	E	0	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites.	Unlikely to occur. No suitable habitat present on the subject site.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V		11	Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	Possible but unlikely to occur. Species could forage on the subject site as part of a wider range, but it has not been recorded on or near the subject site. The single record within the locality is dated at 2000 at Kurnell.
Macropodidae	*Notamacropus parma*	Parma Wallaby	V	E	V	Once occurred in north-eastern NSW from the Queensland boarder to the Bega area in the southeast. Their range is now confined to the coast and ranges of central and northern NSW from the Gosford district to south of the Bruxner Highway between Tenterfield and Casino.	Unlikely to occur. Subject site is outside of the species' range.
Macropodidae	*Petrogale penicillata*	Brush-tailed Rock-wallaby	E	V	0	Prefers rocky habitats, including loose boulder-piles, rocky outcrops, steep rocky slopes, cliffs, gorges, and isolated rock stacks. Vegetation types associated with the species include dense forest, wet sclerophyll forest, vine thicket, dry sclerophyll forest, and open forest.	Unlikely to occur. No suitable habitat present on the subject site.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
Molossidae	Micronomus *norfolkensis*	Eastern Coastal Freetail-bat	V		11	Found in dry sclerophyll forest, woodland, swamp forest and mangrove forests east of the Great dividing Range. Primarily roosts in tree hollows but will also utilise man-made structures.	Possible but unlikely to occur. Highly marginal habitat present at the south of the subject site within the mangrove area. However it is not commonly known from the locality and it has not been recorded on or near the subject site previously.
Muridae	*Pseudomys gracilicaudatus*	Eastern Chestnut Mouse	V		1	In NSW the Eastern Chestnut Mouse is mostly found, in low numbers, in heathland and is most common in dense, wet heath and swamps. In the tropics it is more an animal of grassy woodlands. Occurs north from the Hawkesbury River area as scattered records along to coast and eastern fall of the Great Dividing Range extending north into Queensland. There are however isolated records in the Jervis bay area.	Unlikely to occur. No suitable habitat present on the subject site.
Muridae	*Pseudomys novaehollandiae*	New Holland Mouse		V	0	Occurs in open habitats (heathland, woodland and forest) with a heath understorey and vegetated sand dunes. The species prefers deep soft top soils in order to burrow.	Unlikely to occur. No suitable habitat present on the subject site.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
Peramelidae	*Perameles nasuta*	Long-nosed Bandicoot population in inner western Sydney	EP		26	Forages in parkland and back-yards and shelters mainly under older houses and buildings.	Possible but unlikely to occur. Potential foraging habitat is present on the subject site but this population has only been recorded approximately north of Marrickville.
Peramelidae	*Isoodon obesulus obesulus*	Southern Brown Bandicoot (eastern)	E	E	0	Within NSW, the species is rare and almost exclusively restricted to the coastal fringe of the state, from the southern side of the Hawkesbury River in the north to the Victorian border in the south. More specifically, the subspecies is considered to occur primarily in two areas: Ku-ring-gai Chase and Garigal National Parks; and in the far south-east corner of the state. Occurs within their distribution in a variety of habitats including heathland, shrubland, sedgeland, heathy open forest and woodland.	Unlikely to occur. No suitable habitat present on the subject site.
Phascolarctidae	*Phascolarctos cinereus*	Koala	E	E	8	Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred feed species. Home range size varies with quality of	Unlikely to occur. No suitable habitat present on the subject site.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						habitat, ranging from less than two ha to several hundred hectares in size.	
Pseudocheiridae	*Petauroides volans*	Southern Greater Glider	E	E	0	Occurs in eucalypt forests and woodlands from north-eastern Queensland to the Central Highlands of Victoria. The species has a relatively small home range which consists of numerous tree hollows.	Unlikely to occur. No suitable habitat present on the subject site.
Petauridae	*Petaurus australis*	Yellow-bellied Glider	V	V	0	The Yellow-bellied Glider is found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria. Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils.	Unlikely to occur. No suitable habitat present on the subject site.
Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	V	2799	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosts in large camps and disperses nightly up to 20km to feed in flowering eucalypts.	Recorded within the subject site during nocturnal surveys by Cumberland Ecology in 2017. No roost camps present on the subject site.
Vespertilionidae	*Miniopterus australis*	Little Bent-winged Bat	V		12	Moist eucalypt forest, rainforest or dense coastal banksia scrub. Little Bentwing-bats roost in caves, tunnels and sometimes tree hollows during the	Possible but unlikely to occur. No suitable habitat present on the subject site. Species call was possibly detected

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	from surveys in February 2017 but showed characteristics more similar to the non-threatened Eastern Forest Bat (Vespadelus pumilus).
Vespertilionidae	*Miniopterus* orianae *oceanensis*	Large Bent-winged Bat	V		92	Forages above the canopy and eats mostly moths. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.	Recorded in the subject site. Species call was detected from surveys in February 2017, within the subject site.
Vespertilionidae	*Myotis macropus*	Southern Myotis	V		475	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.	Possible but unlikely to occur. Highly marginal suitable habitat present on the subject site. Species forages over streams and pools which are present on the subject site, however it has been highly disturbed from past land use (being Kogarah Golf Course). The species was not recorded during recent targeted surveys by Cumberland Ecology and there are no existing records on or adjacent to the subject site.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
Vespertilionidae	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V		6	Found mainly in the gullies and river systems that drain the Great Dividing Range. Usually roosts in tree hollows and buildings. Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects.	Unlikely to occur. Highly marginal suitable habitat present on the subject site. Species forages along rivers but would unlikely utilise the subject site itself. Single record from 2006 at Towra Point.
Vespertilionidae	*Chalinolobus dwyeri*	Large-eared Pied Bat	V	V	4	Found in well-timbered areas containing gullies. Roosts in caves, crevices in cliffs and old mine workings frequenting low to mid-elevation dry open forest and woodland close to these features.	Unlikely to occur. No suitable habitat present on the subject site. No roosting habitat present on the subject site or in the vicinity.
Vespertilionidae	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V		2	The Eastern False Pipistrelle is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania. Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings.	Unlikely to occur. Highly marginal suitable habitat present on the subject site.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
Vespertilionidae	*Vespadelus troughtoni*	Eastern Cave Bat	V		0	Found in dry open forest and woodland, near cliffs or rocky overhangs. Species roosts in caves but can occur in disused mine workings, occasionally in colonies of up to 500 individuals. Also found in cliff-lines in wet eucalypt forest and rainforest.	Possible but unlikely to occur. No suitable habitat present on the subject site. Species call was possibly detected from surveys in February 2017 but showed characteristics of the non-threatened Eastern Forest Bat (Vespadelus pumilus) or the Little Forest Bat (Vespadelus vulturnus). Vespadelus troughtoni was considered the least likely.
Gastropoda							
Camaenidae	*Pommerhelix duralensis*	Dural Woodland Snail	E	E	0	Species occurs under rocks or inside curled-up bark within communities in the interface region between sandstone-derived and shale-derived soils.	Unlikely to occur. No suitable habitat present on the subject site.
Camaenidae	*Meridolum maryae*	Maroubra Woodland Snail	E		12	The species is found in the leaf litter of coastal vegetation communities, most commonly in heathland on foredunes also from areas of podsolised dunes/sand plains that support taller heath communities including Eastern Suburbs Banksia Scrub. This species is confined to a narrow band of habitat	Unlikely to occur. No suitable habitat present on the subject site and the subject site is outside of the species' normal range.

Family	Scientific Name	Common Name	BC Act	EPBC Act	Atlas 10km	Habitat Requirements	Likelihood of Occurrence on the Subject Site
						along the coast from the north-eastern corner of the Royal National Park to Palm Beach in Sydney. Records of the species are generally within 1 km of the ocean but occur up to 5 km inland.	
Reptilia							
Elapidae	*Hoplocephalus bungaroides*	Broad-headed Snake	E	V	0	Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. Moves from the sandstone rocks to shelters in crevices or hollows in large trees within 500m of escarpments in summer.	Unlikely to occur. No suitable habitat present on or near to the subject site.

Key: V = Vulnerable, E = Endangered, EP = Endangered Population, CE = Critically Endangered, Ext. = Extinct, Mar. = Marine, Migr. = Migratory

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APPENDIX E :
Assessments of Significance

E.1. Introduction

This appendix contains formal Tests of Significance required under Section 5A of the EP&A Act that have been prepared in accordance of the *Threatened Species Test of Significance Guidelines (NSW Government 2018)*. The Assessments of Significance provide a means by which to gauge the significance of predicted impacts to threatened species, populations and ecological communities listed under the BC Act. They have been prepared to help examine the magnitude of impacts to local occurrences of threatened biota.

Both direct and indirect impacts are considered within these assessments. Direct impacts have been quantified within the assessments and are represented by the development footprint. Whilst it is acknowledged that indirect impacts can potentially be significant for a variety of species, such impacts cannot be mapped or accurately calculated in advance. An important consideration in these assessments is that the direct and indirect impacts are not proposed to take place at one time; rather they will take place progressively.

Tests of Significance have been provided for communities and species listed as vulnerable, endangered or critically endangered under the BC Act. Each Test of Significance is a series of questions (shown as italicised text below) for which a response has been supplied beneath in plain text.

E.1.1. Terminology

The *Threatened Species Test of Significance Guidelines (NSW Government 2018)* utilise and define a number of key terms that are used within a Test of Significance, including subject site, study area, direct impacts, indirect impacts, life cycle, viable, local population, risk of extinction, local occurrence, composition, habitat, extent, importance and locality. The Tests of Significance present below have been prepared in consideration of these terms and the definitions provided in the guidelines.

E.2. Ecological Communities

E.2.1. Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions

Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions is listed as an EEC under the BC Act. This community occurs along the intertidal zones on the shores of estuaries and lagoons (NSW Scientific Commitee 2016), and consists of low succulent herbs and rushes that form plains on tidally inundated land which adjoin open water and mangroves. Salinity levels are highly variable in this community depending on tidal influence, evaporation and fresh water accumulation. Typically, this community is dominated by chenopod species within frequently inundated areas, while other species such as sea rush (*Juncus kraussii*) occupy drier and more elevated terrestrial margins.

Within the Sydney Bioregion, occurrences of this community are small in size, highly fragmented and patchy in distribution (OEH 2013).

Within the locality of the subject site, three small groups of Coastal Saltmarsh patches are present, with the patch within the Landing Lights Wetland in the former Southern Precinct being the largest: These patches are isolated from other areas of Coastal Saltmarsh by developed areas, and none are located within conservation

reserves. Approximately 10 km to the south of the subject site exists a large area of Coastal Saltmarsh within the Towra Point Nature Reserve, which will be protected for conservation in perpetuity.

For the purpose of this Test of Significance, the local occurrence is defined as the patches of saltmarsh in the study area, including the former Northern and Southern Precincts of the Cooks Cove site (**Figure 1**). The distribution of saltmarsh within the study area is made up of:

- Former Northern Precinct Saltmarsh: Less than 0.01 ha of Coastal Saltmarsh is present in northern part of the subject site, in the form of two very small patches. These two isolated patches occur within two open sections of an artificial drainage line which is piped underground for the rest of its extent, within the existing Kogarah Golf Course, and has no connectivity to nearby areas of Coastal Saltmarsh; and
- Former Southern Precinct Saltmarsh: It comprises approximately 1.68 ha that will not be impacted.

The proposed development will remove the two small patches of the community in the former Northern Precinct (subject site). New areas of saltmarsh will be established along the riparian foreshore area of the subject site.

Test of Significance

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

Not applicable.

b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

> *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
>
> *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*

The proposed development will remove the two small traces (less than 0.01 ha) of this community from the subject site (former Northern Precinct). However, the proposed development is unlikely to adversely modify the extent of the ecological community such that its local occurrence overall in the study area (the Cooks Cove site) is likely to be placed at risk of extinction, as larger areas of the community will still remain in the former Southern Precinct.

The proposed development is unlikely to substantially and/or adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction. Although the proposed development will remove the current extent of the community within the subject site, this will be limited to two very small semi-natural patches that are isolated and have no connectivity to any other patches of the community within the study area or locality. Additionally, new areas of saltmarsh are proposed to be established along the riparian foreshore area of the subject site.

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

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

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

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

The proposed development will remove less than 0.01 ha of the community from the total local occurrence (former Northern and Southern Precincts combined).

The Coastal Saltmarsh within the subject site currently exists as two very small isolated patches that have no connectivity to offsite Coastal Saltmarsh. Therefore, the proposed development will not fragment or isolate existing habitat further than its current state.

Only a very small area (less than 0.01 ha) of Coastal Saltmarsh will be removed from within the subject site, located in an isolated area in the middle of the existing Kogarah Golf Course. The small area to be removed is not important to the long-term survival of the community in the locality as far larger areas will be retained in the study area. In addition, the proposed development will create further areas of Coastal Saltmarsh along the riparian foreshore area.

d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

The BC Act currently lists the following areas of outstanding biodiversity value (AOBVs):

- Gould's Petrel habitat;
- Little Penguin population in Sydney's North Harbour habitat;
- Mitchell's Rainforest Snail in Stotts Island Nature Reserve; and
- Wollemi Pine habitat.

The project is not located within or in proximity to the AOBVs and is therefore not likely to have an adverse effect on any AOBVs.

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

Below are the Key Threatening Processes relevant to Coastal Saltmarsh within the subject site along with a description of the proposed development's impacts on each:

- 'Alteration to natural flow regimes of rivers and streams and their floodplains and wetlands'

The two patches of saltmarsh occur within an artificial drainage line which will be modified as a result of the proposed development.

- 'Anthropogenic climate change'

The proposed development is unlikely to significantly contribute to anthropogenic climate change.

- 'Clearing of native vegetation'

Two very small isolated areas of native vegetation within an artificial drainage line will be cleared, however such clearing is unlikely to have a significant detrimental impact on the biodiversity values of the subject site.

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

The proposed development will not increase the frequency of fire within the subject site.

- 'Predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*)'

The proposed development is unlikely to contribute to the predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*).

- 'Invasion of native plant communities by *Chrysanthemoides monilifera* (bitou bush and boneseed)'

The proposed development is unlikely to contribute to the invasion of native plant communities by *Chrysanthemoides monilifera* (bitou bush and boneseed) as continued monitoring of established vegetation within the subject site will occur in accordance with a Cooks Cove Plan of Management. Any invasion of *Chrysanthemoides monilifera* will be dealt with appropriately to ensure native plant communities are maintained in good condition.

- 'Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants'

This key threatening process is unlikely to occur within the subject site as management plans will be implemented to ensure that established native vegetation are maintained in good condition. This includes ongoing maintenance and weeding as in accordance with a Cooks Cove Plan of Management.

Conclusion

The proposed development will remove less than 0.01 ha of Coastal Saltmarsh EEC from the study area, with much larger areas to be retained in the former Southern Precinct at the Landing Lights wetland. The traces of saltmarsh EEC that are proposed to be removed are two very small isolated patches that occur within two open sections of a drainage line which is piped underground for the rest of its extent in the subject site.

Due to the small size of these patches, their isolated location within the existing golf course and their artificial nature, the clearing of these areas is not considered to be a significant impact and are considered unlikely to be important for the long-term survival of the local occurrence of this community in the locality. Nevertheless, mitigation measures to address the loss of saltmarsh habitat are addressed in **Chapter 5** of this report, and

areas of saltmarsh are proposed to be established along the riparian foreshore area of the subject site to compensate for any loss of saltmarsh habitat.

E.3. Fauna

E.3.1. Green and Golden Bell Frog (*Litoria aurea*)

The Green and Golden Bell Frog (*Litoria aurea*) is listed as Endangered under the BC Act and Vulnerable under the EPBC Act. The species is known to inhabit a variety of natural, artificial and disturbed habitats including coastal swamps, marshes, dune swales, lagoons, lakes and other estuarine wetlands, as well as riverine floodplain wetlands, billabongs and constructed wetlands such as detention basins, farm dams, bunded areas, drains and ditches (Pyke and White 2001, DEC (NSW) 2005) .The Green and Golden Bell Frog breeds during summer when conditions are at their warmest, preferring times after heavy rain in January and February (DEC (NSW) 2005, TSSC 2014). The species is highly mobile and has been known to travel between breeding sites covering large distances of to 1-1.5km in a single day/night (Pyke and White 2001).

Within the locality, over 800 occurrences of the Green and Golden Bell Frog have been recorded (EES 2021). These include occurrences at Sans Souci and within the study area, including the subject site. The species has also been recorded within the nearby Parks and Reserves outside of the locality including Towra Point Nature Reserve, Botany Bay National Park and the Royal National Park.

The subject site contains a key Green and Golden Bell Frog population known as the "Arncliffe population", which has been monitored by Dr Arthur White on behalf of RMS for many years (A White pers comm.). Most of the existing records for the species that are in the OEH Wildlife Atlas were produced by the work of Dr Arthur White. However, some work has been done by Cumberland Ecology to survey for the species on the Kogarah Golf Course during 2005, 2009, 2015 and 2017. Surveys by Cumberland Ecology (2006, 2010) recorded the species within the subject site in 2005 and 2009; however, no individuals were recorded in surveys conducted in 2015 or 2017.

Low numbers of records around 2015-2017 of the Arncliffe Population are likely to be attributable to two factors. Firstly, due to low rainfall and poor conditions for frogs prevailing in early and mid 2016. Secondly, removal of animals for an approved captive breeding program as explained below and in more detail in **Section 3.3.3 i.**

In early 2016 the WestConnex project was approved. A Green and Golden Bell Frog Plan of Management' (hereafter referred to as the 'RMS management plan') (Eco Logical Australia 2016) has since been prepared and approved for the Westconnex project.

The Westconnex project proposal entailed provision to create a series of new breeding ponds at the Marsh Street wetlands. That proposal, put forward as part of the EIS for Westconnex, was also based upon artificial breeding of the species, with adults to be collected and transported off site to use as breeding stock. These proposed measures were included in the RMS management plan (Eco Logical Australia 2016). The aim was to release young captive bred frogs back into Marsh Street and the original RTA ponds.

More intensive monitoring of Green and Golden Bell Frogs is now occurring for the RMS approved project. In late 2016 and early 2017, Dr White located a small number of frogs (5-6) just south of the subject site, within the former Southern Precinct. Two adults were captured and transported off site as per the approved RMS management plans. Cumberland Ecology also recorded two Green and Golden Bell Frog individuals in the RTA ponds in early 2020. Since this time, as part of the WestConnex project, the Arncliffe population has increased again and continues to be supplemented with tadpoles from the captive breeding program. Based on recent monitoring surveys undertaken by AMBS Ecology and Heritage (AMBS Ecology & Heritage 2020, 2021b, a), the growing Arncliffe population appears to continue to be mainly based around the RTA ponds as well as the new Marsh Street wetland habitat, with scattered records also occurring within the southern portion of the subject site and in the former Cooks Cove Southern Precinct.

Assessment of Significance

a) *in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.*

The Arncliffe Population is under active management according to the RMS Management Plan. The population is currently increasing and continues to be supplemented with tadpoles from the captive breeding program.

The proposed development will result in the loss of some foraging and dispersal habitat for the species consisting of open grassed areas adjacent to water bodies and water bodies themselves. None of the water bodies to be removed because of the proposed development are considered to be breeding habitat due to the presence of Mosquito Fish (*Gambusia holbrooki*). All known breeding habitat within the RTA ponds located along the subject site's south-western boundary will be retained.

Although areas of foraging habitat will be removed, the retention of known breeding ponds within the subject site, in addition to the majority of the habitat in the south-western portion of the subject site surrounding the RTA ponds, make it unlikely that the proposed development will have an adverse effect on the life cycle of the species such that a viable local population is likely to be placed at risk of extinction.

b) *in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:*

> *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
>
> *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*

Not applicable.

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

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

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

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

Based on the distribution of historical and more recent records of the species, some potential foraging and dispersal habitat for the Green and Golden Bell Frog will be removed because of the proposed development in the central and eastern parts of the subject site. However as explained above, the breeding ponds and the majority of known foraging habitat surrounding the RTA ponds, represented by the south-western portion of the subject site, will be retained within the land to be zoned as RE1. In accordance with the approved conditions for the Westconnex project, these areas will include the reinstated frog habitat in the location of the existing Westconnex construction compound.

Currently, no habitat connectivity between the subject site and areas to the north, east or west exists for the species as the subject site is bound by Cooks River and developed areas. Connectivity between the subject site and areas to the south does exist. Current habitat connectivity for the species is present at two locations along the southern boundary of the subject site and consists of a drainage line and an over-land crossing. These crossings will remain in place during the construction of the proposed development.

The foraging habitat to be removed is unlikely to be important to the long-term survival of the species in the locality. The habitat does not constitute preferred breeding habitat and the only known breeding habitat within the subject site will be retained. The project will continue to facilitate connectivity for the species to disperse to adjacent areas of habitat within the subject site and to the Marsh St breeding ponds.

d) *whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)*

The BC Act currently lists the following AOBVs:

- Gould's Petrel habitat;
- Little Penguin population in Sydney's North Harbour habitat;
- Mitchell's Rainforest Snail in Stotts Island Nature Reserve; and
- Wollemi Pine habitat.

The project is not located within or in proximity to the AOBVs and is therefore not likely to have an adverse effect on any AOBVs.

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

Below are the key threatening processes listed under the BC Act that are likely to affect the Green and Golden Bell Frog along with a brief description of how the proposed development will impact them:

- 'Alteration to natural flow regimes of rivers and streams and their floodplains and wetlands'

No wetlands are present on the subject site. The wetlands in the south of the study area exist on reclaimed land and its current flow regime is man-made. Nevertheless, future flow regimes will be managed to provide suitable habitat for Green and Golden Bell Frogs under a Cooks Cove Plan of Management.

- 'Anthropogenic climate change'

The proposed development is unlikely to significantly contribute to anthropogenic climate change.

- 'Clearing of native vegetation'

Small areas of degraded and planted native vegetation will be cleared, however such clearing is unlikely to have a significant detrimental impact on the biodiversity values of the subject site. Additional areas of vegetation will be planted and managed for biodiversity in the long term.

- 'Infection of frogs by amphibian chytrid causing the disease chytridiomycosis'

It is unlikely that the proposed action will cause the spread of chytridiomycosis within the subject site. A construction environmental management plan will be implemented prior to any construction works which will outline protocols to avoid the spread of the disease onto or out of the subject site.

- 'Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants'

This key threatening process is unlikely to occur within the subject site as management plans will be implemented to ensure that established native vegetation are maintained in good condition. This includes ongoing maintenance and weeding under a Cooks Cove Plan of Management.

- 'Infection of native plants by *Phytophthora cinnamomi*'

It is unlikely that the proposed action will cause the infection of *Phytophthora cinnamomi* within the subject site. A construction environmental management plan will be implemented prior to any construction works which will outline protocols to avoid the spread of this infection onto or out of the subject site.

- 'Predation by *Gambusia holbrooki* (plague minnow or mosquito fish)'

The mosquito fish is already present within many of the ponds within the subject site. This key threatening process has been considered and will be mitigated through measures outlined in the Green and Golden Bell Frog Management Plan, which will be updated for the detailed design Development Application. This includes making any established habitat drainable to control outbreaks of the species if and/or when they occur.

- 'Predation by the European red fox (*Vulpes vulpes*)'

Although fox predation is listed as a key threatening process that could potentially threaten the Green and Golden Bell Frog, it has not been identified as a primary prey species for this animal (DEC (NSW) 2005). Nevertheless, the remains of the Green and Golden Bell Frogs have been identified in fox scats within key populations of the species. To mitigate this key threatening process within the subject site, long-term

monitoring of the population will occur as outlined in the Green and Golden Bell Frog Management Plan. The results of such monitoring will provide recommendations to reduce the impacts of this key threatening process within the subject site if found to occur.

Conclusion

The Arncliffe Population is under active management according to the RMS Management Plan. The population is currently increasing and supplemented by tadpoles from the captive breeding program.

The proposed development will remove some areas of potential foraging and dispersal habitat for this species within the subject site, in the central and eastern portions of the site.

Although potential foraging habitat will be removed, the only known breeding locations within the subject site will be retained as well as most of the utilised foraging habitat. Furthermore, a Green and the Golden Bell Frog Management Plan will apply to the subject site, which will complement and link with the RMS management plan. Under the plan, measures will be taken that will improve the prospects for animals released at Marsh Street under the RMS management plan Therefore, the proposed development is unlikely to have a significant negative impact on the species.

E.3.2. Grey-headed Flying-fox (*Pteropus poliocephalus*)

The Grey-headed Flying-fox is listed as vulnerable under the BC Act and the EPBC Act. The species is distributed along the east coast of Australia from Queensland to South Australia, and can be found in a variety of habitats including subtropical and temperate rainforests, tall sclerophyll forest and woodlands, heaths, swamps, gardens and orchards. The species roosts in camps that are often close to water and within 20 km of a regular food source. The species is known to travel upwards to 50 km to forage, but more commonly commutes less than 20 km (OEH 2016b).

The Grey-headed Flying-fox has numerous records from the locality and is known to forage on the subject site and within trees in the wider study area. Individuals have frequently been observed feeding on blossoms and fruits of trees on the golf course. However, the species is highly mobile and are likely to fly from an active camp at least two km from the subject site. Three known 'active' camps are located within the locality:

- Wolli Creek: approximately 2 km to the west:
- Centennial Park, approximately 7.5 km to the north-east, and
- Kareela, approximately 10 km to the south-west of the subject site.

(Note that there are some additional camps are located within the locality of the subject site, however, these are 'inactive' camps as no Grey-headed Flying-foxes have been recently recorded utilising them (Department of the Environment and Energy 2015)).

Assessment of Significance

a) *in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.*

The species has been recorded foraging on flowering and fruiting trees throughout the subject site during nocturnal surveys by Cumberland Ecology in March 2017. No camps are present within the subject site and the vegetation present is likely utilised only for foraging as part of a much broader foraging range. The Grey-headed Flying-fox is a highly mobile species with a large foraging range and is known to forage throughout the Sydney region, including areas with sparse street trees.

Approximately 6.67 ha of planted native trees and shrubs occur on the Northern Precinct and it is estimated that approximately 4.36 ha will be removed. Approximately 2.31 ha of existing native tree cover will be retained, including several large figs that exist beside the current golf clubhouse. Additional plantings of trees and shrubs will occur in the subject site as part of the landscaping. It is not possible to provide an accurate estimate of trees to be replanted at the rezoning stage. However, this will be revisited in the detailed design stage of the project.

Although some foraging habitat will be removed from the wider home range of the nearest flying fox camp as a result of the proposed action, the subject site is only part of a much broader foraging range and is unlikely to be important to the species long-term survival in the locality. Therefore, the proposed development is unlikely to have an adverse effect on the life cycle of the species such that the local population would likely be placed at risk of extinction.

(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

> *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
>
> *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*

Not applicable.

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

> *(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and*
>
> *(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and*
>
> *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality*

Approximately 4.36 ha of suitable foraging habitat will be removed as a result of the proposed development and no known roosting habitat will be removed.

The foraging habitat within the subject site currently exists as an isolated patch of habitat that is bound by developed areas and has little connectivity to offsite habitat. The proposed development will not further isolate the habitat present; however, it will result in further fragmentation of existing habitat in the locality. That notwithstanding, the Grey-headed Flying-fox is a highly mobile species that is capable of flying over disturbed land and accessing fragmented habitats, and therefore the fragmentation caused by the project is not likely to impact this species.

No Grey-headed Flying-fox camps are located on the subject site and the foraging habitat available is likely only utilised as part of a much broader foraging range. Therefore, the habitat to be removed is unlikely to be important for the long-term survival of this species in the locality. Additionally, much larger areas of potential habitat occur throughout the wider locality in more heavily vegetated areas including Wolli Creek Regional Park.

d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

The BC Act currently lists the following AOBVs:

- Gould's Petrel habitat;
- Little Penguin population in Sydney's North Harbour habitat;
- Mitchell's Rainforest Snail in Stotts Island Nature Reserve; and
- Wollemi Pine habitat.

The project is not located within or in proximity to the AOBVs and is therefore not likely to have an adverse effect on any AOBVs.

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

The following Key Threatening processes listed under the BC Act are likely to affect the Grey-headed Flying-fox:

- 'Clearing of native vegetation'

Approximately 4.36 ha of planted native vegetation will be cleared, however such clearing is unlikely to have a significant impact on a local population of the Grey-headed Flying-fox. Additional areas of native vegetation will persist within reserves in the locality, providing suitable habitat for the species in the long-term.

- 'Anthropogenic climate change'

The proposed development is unlikely to significantly contribute to anthropogenic climate change.

- 'Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants'

This key threatening process is unlikely to occur within the study area as management plans will be implemented to ensure that established native vegetation are maintained in good condition. This includes ongoing maintenance and weeding under a Cooks Cove Plan of Management.

- 'Invasion and establishment of exotic vines and scramblers'

This key threatening process is unlikely to occur within the subject site as management plans will be implemented to ensure that areas of established native vegetation are maintained in good condition. This includes ongoing maintenance and weeding under a Cooks Cove Plan of Management.

- 'Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae'

Establishment of native vegetation will occur under the supervision of professional bushland regenerators as outlined in a Cooks Cove Plan of Management, which will be prepared for the detailed design stage of the project. Such professionals are aware of exotic rust fungi and are unlikely to plant individuals showing symptoms of carrying these fungi. Additionally, ongoing management of the vegetation establishment works will occur, ensuring that any detection of the fungi will be dealt with appropriately.

- 'Forest Eucalypt dieback associated with over-abundant psyllids and bell miners'

This key threatening process is unlikely to occur within the subject site as Bell Miners are not known to occur within the study area.

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

The proposed development is unlikely to increase the frequency of fire within the subject site as any bushfire requirements will need to be adhered to for the future rezoning.

- 'Infection of native plants by *Phytophthora cinnamomi*'

It is unlikely that the proposed action will cause the infection of *Phytophthora cinnamomi* within the subject site. A construction environmental management plan will be implemented prior to any construction works which will outline protocols to eliminate the spread of this infection onto or out of the subject site.

Conclusion

The proposed development will remove some areas of planted native trees and shrubs that are used for foraging by this species, but will not impact a flying fox camp directly. Such removal of foraging habitat needs to be seen in context.

Approximately 6.67 ha of native trees and shrubs occur in the subject site and it is estimated that 4.36 ha will be removed. Approximately 2.31 ha of existing tree cover will be retained, including several large figs that exist

beside the current golf clubhouse. Additional plantings of trees and shrubs will occur in the subject site as part of the landscaping of the project. It is not possible to provide an accurate estimate of trees to be replanted at the rezoning stage; however, the replanting will be revisited in the detailed design stage.

Although the ongoing loss of foraging habitat is a threatening process to the species, the foraging habitat to be removed is utilised as part of a much broader foraging range. Furthermore, additional areas of suitable foraging habitat within the locality will be retained within reserves in perpetuity and the habitat to be removed is unlikely to be important for the long-term survival of a local population in the locality. Therefore, the proposed development is unlikely to have a significant impact on the Grey-headed Flying-fox.

E.3.3. Large Bent-winged Bat (Miniopterus schreibersii oceanensis)

The Large Bent-winged Bat is listed as Vulnerable under the BC Act and not listed under the EPBC Act (OEH 2016a). This species occurs along the entire eastern coast of Australia, from Victoria to the tip of Cape York in Queensland. The Eastern Bentwing bat hunts in forested areas, catching moths and other flying insects above the tree tops. Caves are the primary roosting habitat, but it also uses derelict mines, storm-water tunnels, buildings and other man-made structures (OEH 2016a).

There are over 90 records of bathe species in the locality and it has been recorded foraging within the subject site. However, the subject site provides limited roosting opportunities for the species as few man-made structures such as culverts and buildings are present and despite searches, no roosts of this species have been found. Generally, the buildings that are present are well maintained and appear to lack adequate entry points.

Foraging habitat is present in the areas of planted native trees and shrubs, and in wetland areas. The areas with planted trees and shrubs are degraded and artificial and the quality of the habitat they provide is relatively low.

Approximately 6.67 ha of trees and shrubs occur on the Northern Precinct and it is estimated that 4.36 ha will be removed. Approximately 2.31 ha of existing tree cover will be retained, including several large figs that exist beside the current golf clubhouse. Additional plantings of trees and shrubs will occur in the subject site as part of the landscaping for the project. It is not possible to provide an accurate estimate of trees to be replanted at the rezoning stage, however this will be revisited in the detailed design stage.

Assessment of Significance

a) *in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction*

The habitat to be removed as a result of the proposed development is likely only utilised for foraging purposes as part of a broader foraging range. Additionally, no preferred roosting habitat will be removed. Therefore, the proposed development is unlikely to have an adverse effect on the life cycle of this species such that a viable local population would likely be placed at risk of extinction.

b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

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

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

Not applicable.

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

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

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

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

The proposed development will remove approximately 4.36 ha of potential foraging habitat for the species within the subject site, which is made up of woody vegetation and wetlands. No preferred roosting habitat will be directly impacted

The habitat within the subject site is currently bounded by developed areas and has little connectivity to offsite habitat. The proposed development will not fragment or isolate habitat further than its current levels. Furthermore, the Large Bent-winged Bat is highly mobile and capable of flying over disturbed areas and accessing fragmented habitats.

The potential habitat available within the subject site for this species is not considered important to the long-term survival of a local population. A limited area of non-preferred roosting habitat is present and the foraging habitat present in areas of planted vegetation is degraded and artificial. Accordingly, the quality of the habitat they provide is relatively low.

d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

The BC Act currently lists the following AOBVs:

- Gould's Petrel habitat;
- Little Penguin population in Sydney's North Harbour habitat;
- Mitchell's Rainforest Snail in Stotts Island Nature Reserve; and
- Wollemi Pine habitat.

The project is not located within or in proximity to the AOBVs and is therefore not likely to have an adverse effect on any AOBVs.

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

Below are the key threatening processes listed under the BC Act that are likely to affect the Large Bent-winged Bat along with a brief description of how the proposed development will impact them.

- 'Clearing of native vegetation'

Small areas of degraded native vegetation will be cleared, however such clearing is unlikely to have a significant detrimental impact on the species because the habitat to be removed is likely only utilised periodically as part of a broader foraging range.

- 'Anthropogenic climate change'

The proposed development is unlikely to significantly contribute to anthropogenic climate change.

- 'Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants'

The proposed development is unlikely to contribute to this key threatening process as ongoing maintenance and weeding will occur under a Cooks Cove Plan of Management.

- 'Invasion and establishment of exotic vines and scramblers'

This key threatening process is unlikely to occur within the subject site as it would be expected that any vegetation within the proposed development will be maintained in the long term. This includes ongoing maintenance and weeding under a Cooks Cove Plan of Management.

- 'Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae'

Establishment of native vegetation will occur within the subject site under the supervision of professional bushland regenerators as outlined in a Cooks Cove Plan of Management, which will be prepared as part of the detailed design stage of the project. Such professionals are aware of exotic rust fungi and are unlikely to plant individuals showing symptoms of carrying this fungi.

Additionally, ongoing management of the vegetation establishment works will occur, ensuring that any detection of the fungi will be dealt with appropriately.

- 'Forest Eucalypt dieback associated with over-abundant psyllids and bell miners'

This key threatening process is unlikely to occur within the subject site as management plans will be implemented to ensure that established native vegetation are maintained in good condition. Monitoring will occur throughout the subject site over the long-term, which will allow for the early identification of this key threatening process and the early implementation of ameliorative measures as required. Furthermore, Bell Miners are not known to occur within the study area.

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

The proposed development is unlikely to increase the frequency of fire within the subject site as any bushfire requirements will need to be adhered to for the future rezoning.

- 'Infection of native plants by *Phytophthora cinnamomi*'

It is unlikely that the proposed action will cause the infection of *Phytophthora cinnamomi* within the subject site. A construction environmental management plan will be implemented prior to any construction works which will outline protocols to eliminate the spread of this infection onto or out of the subject site.

Conclusion

The proposed development will remove approximately 4.36 ha of potential foraging and no preferred roosting habitat for the Large Bent-winged Bat. The foraging habitat to be removed is likely only utilised periodically as part of a broader foraging range and is not considered important to the long-term survival of a local population. Therefore, the proposed development is unlikely to have a significant impaction on this species.

E.3.4. Powerful Owl (*Ninox strenua*)

The Powerful Owl is distributed from Mackay to south western Victoria, mainly on the coastal side of the Great Dividing Range. This species occurs in many vegetation types from woodland and open sclerophyll to tall open wet forest and rainforest. It requires large tracts of native vegetation but can survive in fragmented landscapes. It roosts in dense vegetation and nests in large tree hollows. The Powerful Owl is listed as Vulnerable under the BC Act (OEH 2014b).

There are 500 records of Powerful Owl within the locality. Potential foraging habitat for this species occurs throughout the subject site in the areas of planted trees and shrubs. It is possible that suitable nesting habitat could occur within the subject site as one hollow-bearing tree with a large hollow occurs in the southern area of the subject site, and some of the large mature *Ficus* trees in the north could potentially contain large hollows. The Powerful Owl is considered to have the potential to occur within the subject site given the species is known to utilise fragmented habitat within urban areas, however the subject site is considered to only provide marginal habitat for this species.

Assessment of Significance

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

The Powerful Owl has the potential to utilise the subject site as foraging habitat as part of a much larger foraging range. It is a mobile species that accesses resources from across a wide area and would not depend upon resources contained on the subject site for its long-term survival.

It is possible, but unlikely, that breeding habitat could occur within the subject site as one hollow-bearing tree with a large hollow has been recorded from the southern area of the subject site, and some of the large mature

Ficus trees in the north could potentially contain large hollows. However, most of these trees will be retained as part of the proposed development. Therefore, the proposed development is unlikely to place a viable local population of the species at risk of extinction due to the limited amount of foraging and breeding habitat present within the subject site.

b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

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

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

Not applicable.

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

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

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

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

Approximately 4.36 ha of planted native vegetation will be cleared for the proposed development, comprising potential foraging and minor roosting habitat for the species.

The foraging habitat within the subject site is currently bound by developed areas and has little connectivity to offsite habitat. The proposed development will not fragment or isolate habitat further than its current levels. Furthermore, the Powerful Owl is a highly mobile species that is capable of flying over disturbed land and accessing fragmented habitats.

The small area of foraging habitat available is likely only utilised periodically as part of a much broader foraging range. Therefore, the habitat to be removed is unlikely to be important for the long-term survival of this species in the locality. Much larger areas of potential habitat occur throughout the wider locality.

d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

The BC Act currently lists the following AOBVs:

- Gould's Petrel habitat;
- Little Penguin population in Sydney's North Harbour habitat;

- Mitchell's Rainforest Snail in Stotts Island Nature Reserve; and
- Wollemi Pine habitat.

The project is not located within or in proximity to the AOBVs and is therefore not likely to have an adverse effect on any AOBVs.

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

The following Key Threatening processes listed under the BC Act are likely to affect the Powerful Owl:

- 'Clearing of native vegetation'

Approximately 4.36 ha of native vegetation will be cleared, however such clearing is unlikely to have a significant detrimental impact on the biodiversity values of the subject site.

- 'Anthropogenic climate change'

The proposed development is unlikely to significantly contribute to anthropogenic climate change.

- 'Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants'

This key threatening process is unlikely to occur within the subject site as management plans will be implemented to ensure that established native vegetation are maintained in good condition. This includes ongoing maintenance and weeding under a Cooks Cove Plan of Management.

- 'Invasion and establishment of exotic vines and scramblers'

This key threatening process is unlikely to occur within the subject site as it would be expected that any vegetation within the proposed development will be maintained in the long term. For the subject site, management plans will be implemented to ensure that established native vegetation are maintained in good condition. This includes ongoing maintenance and weeding as outlined in a Cooks Cove Plan of Management, which will be prepared for the detailed design stage of the project.

- 'Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae'

Establishment of native vegetation will occur in the subject site under the supervision of professional bushland regenerators as outlined in a Cooks Cove Plan of Management, which will be revised for the detailed design DA. Such professionals are aware of exotic rust fungi and will not plant individuals showing symptoms of carrying this fungi.

Additionally, ongoing management of the vegetation establishment works will occur, ensuring that any detection of the fungi will be dealt with appropriately.

- 'Forest Eucalypt dieback associated with over-abundant psyllids and bell miners'

This key threatening process is unlikely to occur within the subject site as management plans will be implemented to ensure that established native vegetation are maintained in good condition. Monitoring will occur throughout the subject site over the long-term, which will allow for the early identification of this key threatening process and the early implementation of ameliorative measures as required. Bell Miners are not known to occur within the study area.

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

The proposed development is unlikely to increase the frequency of fire within the subject site as any bushfire requirements will need to be adhered to for the future rezoning.

- 'Infection of native plants by *Phytophthora cinnamomi*'

It is unlikely that the proposed action will cause the infection of *Phytophthora cinnamomi* within the subject site. A construction environmental management plan will be implemented prior to any construction works which will outline protocols to eliminate the spread of this infection onto or out of the study area.

- 'Loss of hollow-bearing trees'

Hollow-bearing trees will be cleared as part of the proposed development. The majority of the hollows are not suitable in size for the Powerful Owl. One tree in the southern parts of the subject land and the large *Ficus* trees in the north of the subject site could potentially contain large hollows suitable for the species, although it has not been recorded roosting in these trees during surveys by Cumberland Ecology, or anywhere within the subject site. Therefore, the removal of hollow-bearing trees is unlikely to cause a significant impact to the species.

Conclusion

The proposed development will remove a relatively small area of foraging habitat for this species within the subject site that is likely only utilised periodically as part of a much broader foraging range. Due to this and that no known suitable nesting habitat will be removed within the subject site; the habitat to be removed is unlikely to be important for the long-term survival of a local population in the locality.

Approximately 6.67 ha of native trees and shrubs occur in the subject site and it is estimated that 4.36 ha will be removed. Approximately 2.31 ha of existing tree cover will be retained, including a number of large figs that exist beside the current golf clubhouse. Additional plantings of trees and shrubs will occur in the subject site as part of the landscaping for the project. It is not possible to provide an accurate estimate of trees to be replanted at the rezoning stage.

Although a small area of foraging habitat will be removed, this habitat is likely utilised as part of a much broader foraging range. Furthermore, additional areas of suitable foraging habitat within the locality will be retained within reserves in perpetuity and the habitat to be removed is unlikely to be important for the long-term survival of a local population in the locality. The species is also known to utilise isolated street trees and garden areas, which would be present because of the proposed development. Therefore, the proposed development is unlikely to have a significant impact on the Powerful Owl.

FIGURES

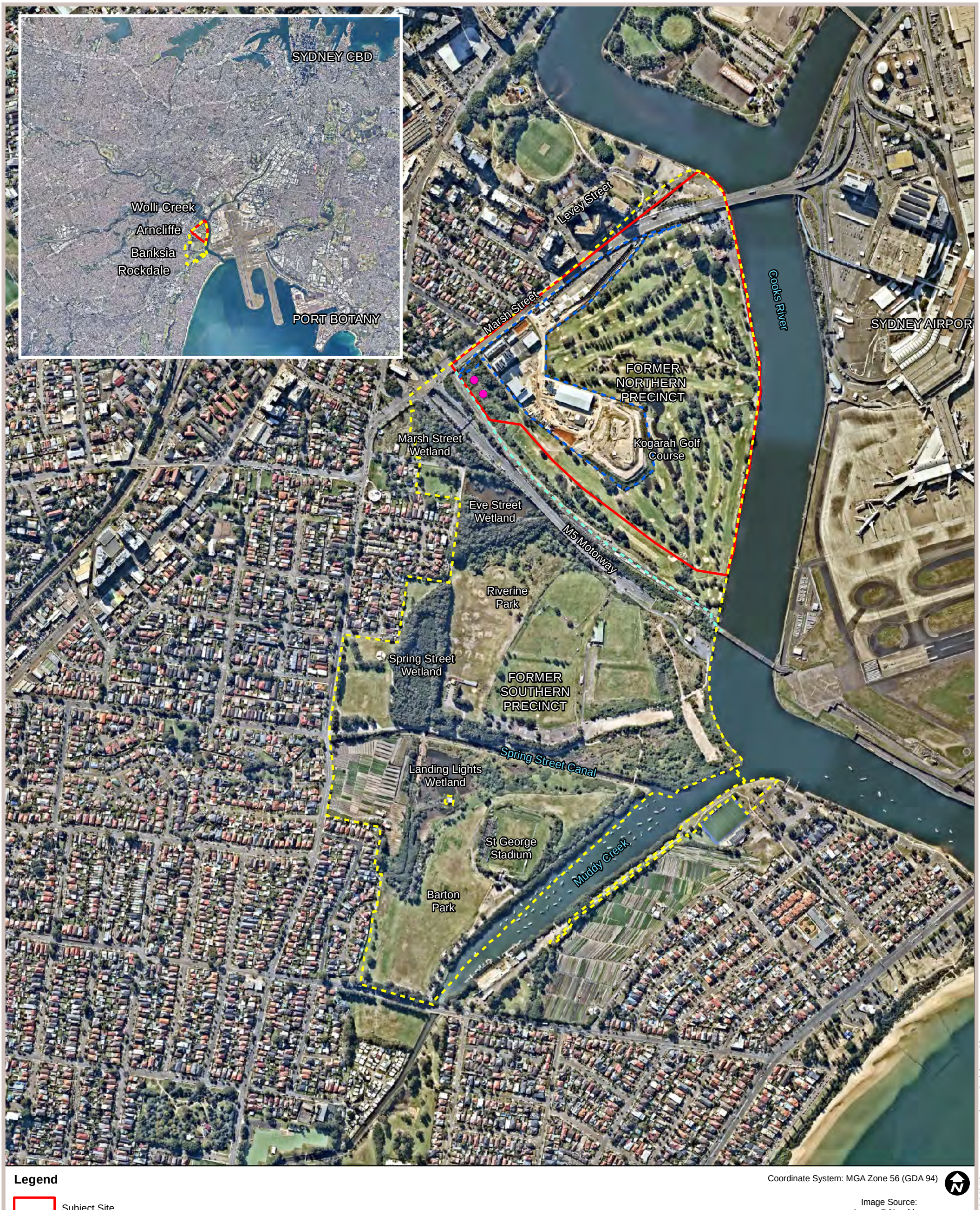
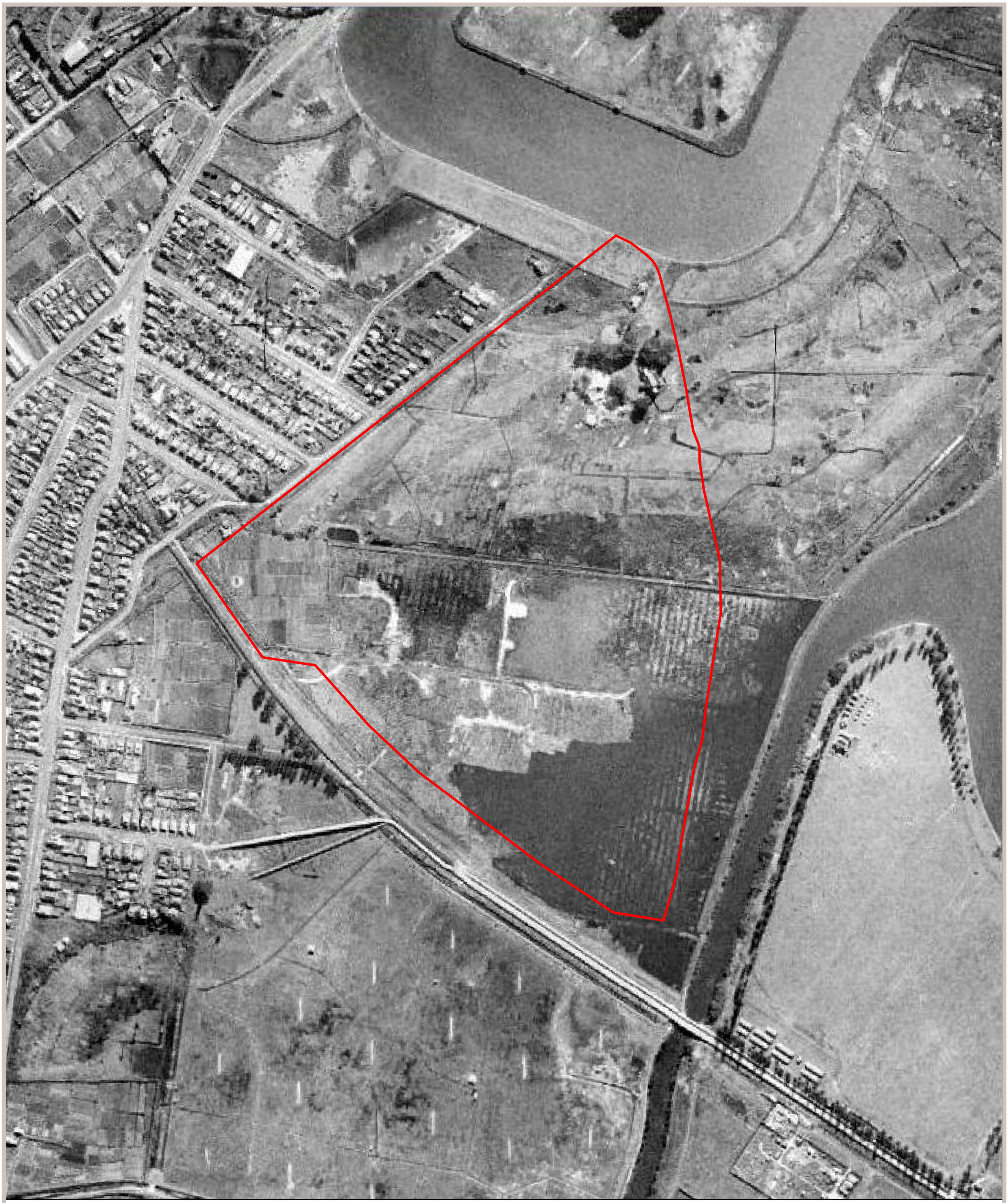


Figure 1. Location of the subject site

I:\...\15089\Figures\RP11\20230223\Figure 1. Location_Subject Site



Legend

Subject Site

Coordinate System: MGA Zone 56 (GDA 94)

Image Source:
Image © SixMaps
(dated 1943)

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I:\...\15089\Figures\RP11\20211011\Figure 2. Historical Photo_Subject Site

Figure 2. Historical photo of the subject site (dated 1943)

0 100 200 m

Figure 3. The Cooks Cove Master Plan

Image Source: Cook Cove Inlet, 2022

I:\...\15089\Figures\RP11\20230223\Figure 3. Master Plan

RMS 1
RMS 2
RMS 3
RMS 4
RMS 5
RMS 6
Q1
Q2
Q3
Q4
Q5
Q6
Q7

Legend

Subject Site

WestConnex Temporary Construction Compound

Flora Survey Locations

Plot 20 x 20m

BBAM (2017)

BBAM (2017)/ BAM (2021)

Transect

BBAM (2017)

BBAM (2017)/ BAM (2021)

Random Meanders

Coordinate System: MGA Zone 56 (GDA 94)

Image Source:
Image © NearMaps
(dated 6-08-2021)

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I:\...\15089\Figures\RP11\20211011\Figure 4. Flora survey locations_2017

Figure 4. Flora survey locations

0 50 100 m

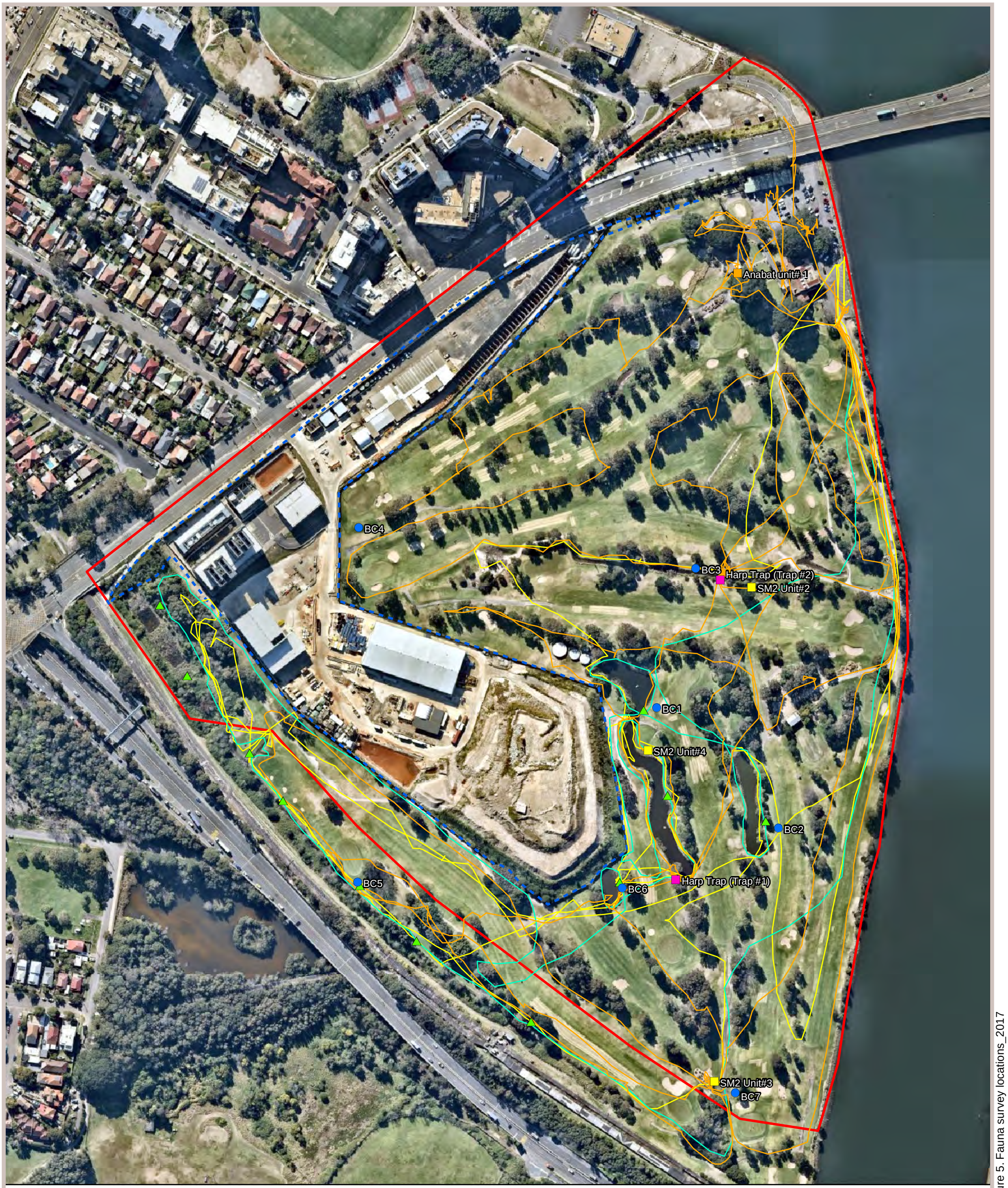

Figure 5. Fauna survey locations

Legend

Subject Site

WestConnex Temporary Construction Compound

Vegetation Community (OEH, 2016)

Urban_E/N: Urban Exotic/Native

Note: This map shows the vegetation mapped by OEH (2016) prior to clearance by WestConnex, and is therefore no longer accurate within the WestConnex construction site.

Coordinate System: MGA Zone 56 (GDA 94)

Image Source:
Image © NearMaps
(dated 6-08-2021)

Data Source:
OEH (2016). The Native Vegetation of the Sydney Metropolitan Area. Office of Environment and Heritage NSW.

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0 50 100 m

I:\...\15089\Figures\RP11\20211011\Figure 6. Vegetation Communities (OEH)_Subject Site

Figure 6. Vegetation communities within the subject site by OEH (2016) prior to clearing by WestConnex

Legend

Subject Site

WestConnex Temporary Construction Compound

Vegetation Community

Mangroves

Saltmarsh

Planted Native Vegetation

Exotic Vegetation

Lawns and other Exotic Grassland

Water Body with Fringing Aquatic Vegetation

Coordinate System: MGA Zone 56 (GDA 94)

Image Source:
Image © NearMaps
(dated 6-08-2021)

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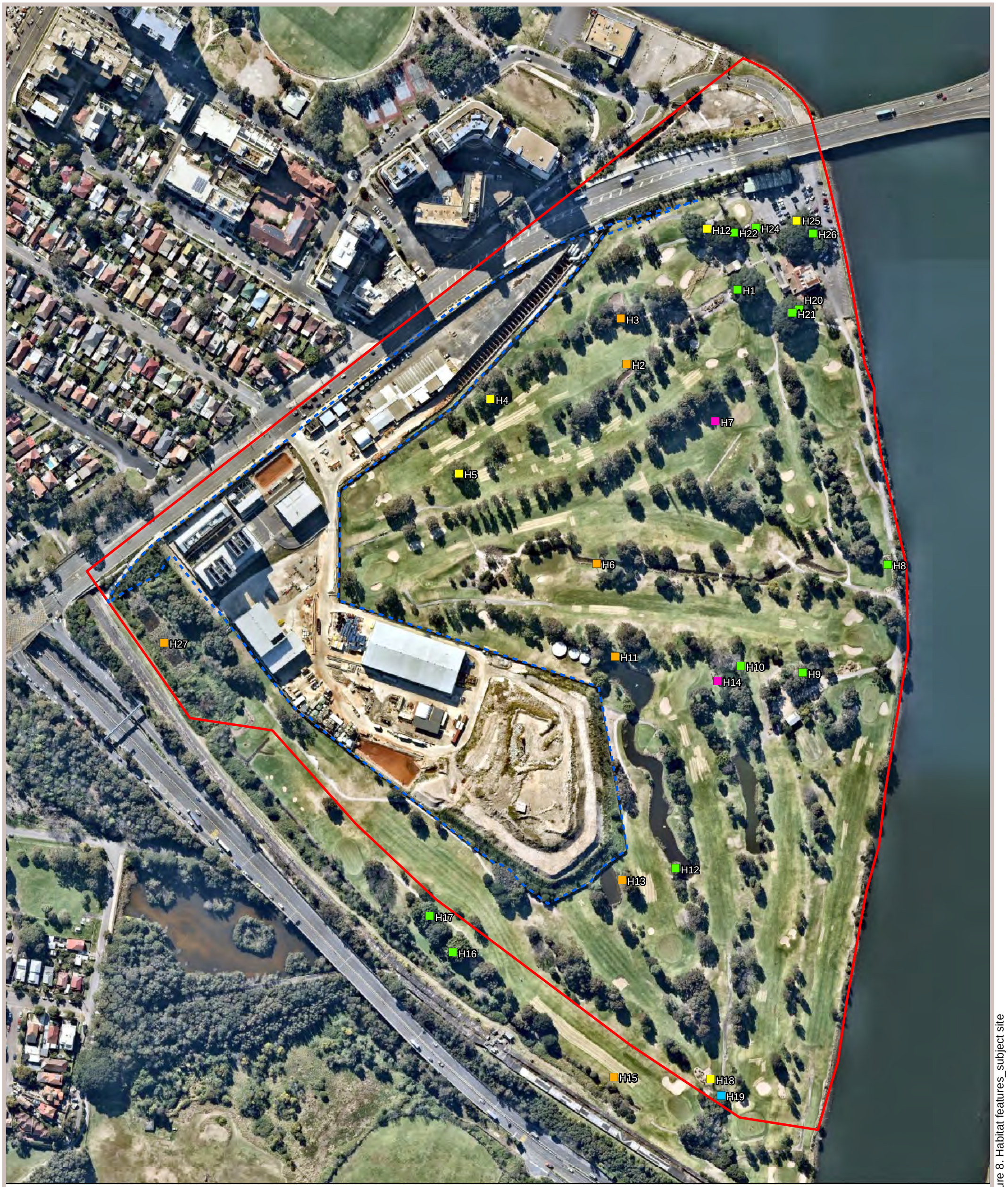
I:\...\15089\Figures\RP11\20211011\Figure 7. Vegetation Communities_Subject Site

Figure 7. Vegetation communities within the subject site

0 50 100 m



Legend

- Subject Site
- WestConnex Temporary Construction Compound

Habitat Type

- Hollow-bearing Tree
- Habitat Tree
- Mangroves
- Water Body
- Culvert

Coordinate System: MGA Zone 56 (GDA 94)

Image Source:
Image © NearMaps
(dated 6-08-2021)

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0 50 100 m

I:\...\15089\Figures\RP11\20230223\Figure 8. Habitat features_subject site

Figure 8. Habitat features within the subject site

Legend

Subject Site

WestConnex Temporary Construction Compound

Threatened Fauna

Large Bent-winged Bat

Green and Golden Bell Frog

Coordinate System: MGA Zone 56 (GDA 94)

Image Source:
Image © NearMaps
(dated 6-08-2021)

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I:\...\15089\Figures\RP11\20211011\Figure 9. Threatened fauna locations_subject site

Figure 9. Threatened fauna locations within the subject site

0 50 100 m

Legend

- Subject Site
- WestConnex Temporary Construction Compound
- Vegetation to be removed (indicative)
- Development Footprint

Vegetation Community

- Mangroves
- Saltmarsh
- Planted Native Vegetation
- Exotic Vegetation
- Lawns and other Exotic Grassland
- Water Body with Fringing Aquatic Vegetation

Coordinate System: MGA Zone 56 (GDA 94)

Image Source:
Image © NearMaps
(dated 6-08-2021)

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I:\...\15089\Figures\RP11\20230223\Figure 10. Impact_Vegetation

Figure 10. Indicative mapping of vegetation to be removed

0 50 100 m

Centennial Park camp

Wolli Creek camp

Kareela camp

Legend

- Subject Site
- National Parks and Reserves
- Study Area
- 20 km radius surrounding Wolli Creek camp
- Approximate location of Grey-headed Flying-fox camps in the locality

Habitat Type

- Forest and Woodland Vegetation
- Urban Exotic/Native Vegetation including Plantations

Coordinate System: MGA Zone 56 (GDA 94)

Image Source:
Google Pro (2017)

Data Source:
OEH (2016). The Native Vegetation of the Sydney Metropolitan Area. Office of Environment and Heritage NSW.

DAWE (2021). National Flying-fox monitoring viewer.

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0 1 2 3 4 km

I:\...\15089\Figures\RP11\20211011\Figure 11. Potential_GHFF_Locality

Figure 11. Potential foraging habitat for the Grey-headed Flying-fox within a 20km radius of Wolli Creek camp