# Sports-ground lighting installation at John Fisher Park Curl Curl, NSW: Flora and fauna assessment

FINAL REPORT

Prepared for BBF Planners on behalf of Northern Beaches Council

25 October 2019

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## Acknowledgements


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- Michael Haynes (BBF Planners) and Cameron Henry (Northern Beaches Council)
- Department of the Environment and Energy for access to the Protected Matters Search Tool of the Australian Government
- NSW Environment, Energy and Science for access to the BioNet Atlas of NSW Wildlife.

Biosis staff involved in this project were:

- Matthew Hyde and Kayla Asplet
- Anne Murray (mapping)

# Contents



## Tables



## Figures

# 1 Introduction

## 1.1 Project background

Biosis Pty Ltd was commissioned by BBF Planners on behalf of the Northern Beaches Council (Council) to complete a flora and fauna assessment to describe the ecological values and constraints associated with the proposed installation of sportsground lighting at Frank Gray and Mike Pawley ovals of John Fisher Park, Curl Curl, NSW (the study area).

Biosis understands that Council is proposing to install six lighting poles around the perimeter of Mike Pawley and Frank Gray Oval, all at 30 metres in height (Figure 1). A lighting concept plan and luminosity report has been developed for the proposed lighting installation by APEX Lighting (2018). This plan details 50 Philips OptiVision LED gen 2 BVP525 lighting modules, with a total luminous flux of 183,011 lumens per module, to be fitted out across the lighting six poles.

The Council's asset management group is developing a Development Application (DA) to support the installation of this lighting in accordance with Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Pre-lodgement advice (PLM2018/0253) provided by Council has indicated the requirement for a flora and fauna assessment to accompany the DA submission. This assessment needs to address potential impacts of light spillage into the otherwise 'dark' natural areas along Greendale Creek, as well as potential impacts to light sensitive nocturnal fauna. Mitigation measures to reduce potential impacts are also requested.

Additional requirements to be addressed within the assessment include:

- Warringah Local Environmental Plan (2011).
- Part E, Clause E4 Wildlife Corridors and Clause E5 Native Vegetation of the Warringah Development Control Plan (2011) which requires the consent authority to consider any adverse impacts to land identified as a "Wildlife Corridor" or consists of "Native Vegetation".
- State Environmental Planning Policy (Coastal Management) 2018.
- *Water Management Act 2000*.

The eastern edge of the study area is mapped as 'coastal environment area' under Division 3, Clause 13 of the State Environmental Planning Policy (Coastal Management) 2018, which requires the consent authority to consider whether the proposed development is likely to cause adverse impacts to land designated within the coastal environment area mapping.

The study area and surrounds provides habitat to threatened fauna species, listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and NSW *Biodiversity Conservation Act 2016* (BC Act). Assessments of the potential impacts to these species resulting from the proposed lighting installation needs to be undertaken in accordance with the *Matters for National Environmental Significance Significant Impact Guidelines* (Commonwealth of Australia 2009) for EPBC Act listed species (SIC assessment), and the Test of Significance (ToS) as defined under Part 7 of the BC Act for species listed under the BC Act.

Therefore, the objective of this flora and fauna assessment is to address the requirements outlined by Council and assess the impacts of the proposed lighting installation on any threatened species, populations or ecological communities (biota), or their habitat, listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), *Biodiversity Conservation Act 2016* (BC Act).

## 1.2 The study area

The study area is approximately 5.5 hectares and consists of Mike Pawley and Frank Gray Oval and the riparian corridor of Greendale Creek, which flows to Curl Curl Lagoon in the east (Figure 1). The study area is located within the Northern Beaches Local Government Area (LGA), and is zoned as RE1 – Public Recreation under the Warringah LEP. Harbord Road runs to the west of the study area and crosses Greendale Creek. Each side of the riparian corridor is zoned as public recreation and further to the south, north and east is zoned as low density residential under the Warringah LEP.

## 1.3 Potential impacts of artificial lighting on nocturnal fauna

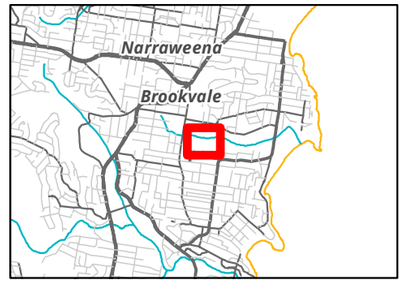
Light is a natural stimulus, which impacts on the physiology, behaviour and movement of all organisms. Artificial lighting alters the length of the natural photoperiod, disrupting the natural circadian rhythm and sensory ecology of organisms. This change in photoperiod can affect the foraging, breeding and dispersal behaviours of fauna. In addition, fauna also use lighting cues as a means for predator detection and habitat selection, both of which are impacted by the introduction of artificial light (Blackwell, DeVault, & Seamans 2015, Roberts et al. 2015).

Based on available research, other impacts resulting from increased lighting pollution include:

- Potential decrease in species abundance and diversity
- Resource partitioning and shifts in foraging niches
- Increased predation
- Alterations to trophic interactions
- Physiological influences on species (particularly mammals)
- Potential behavioural adaptions

The Sydney Basin has an extensive history (over 200 years) of disturbance and modification from foreshore development, industry and increased residential development (Birch and Taylor 1999, 2000; McCready et al. 2000, 2006b).This latter point highlights that in the context of the proposed works, that nocturnal biota within this locality may are already be under pressure due to urban encroachment.

Artificial lighting at night is one of the most common fastest growing types of environmental pollution, increasing at 6% per year globally and identified as a key threat to biodiversity (Robert et al. 2015). Artificial lighting appears to have some level of influence on all tropic levels within urban terrestrial ecosystems, which in turn may result in both positive and negative feedback effects and impact overall ecosystem health. The mitigation options in Table 2 have been developed to address these potential impacts.


**Legend**

Study area

**Light pole (height)**
n - Number of modules

30m

**Plant community type**

PCT1232 - Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion

PCT1234 - Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion

PCT1808 - Common Reed on the margins of estuaries and brackish lagoons along the New South Wales coastline

Urban native/exotic

**Figure 1 Proposed lighting plan at John Fisher Park (Mike Pawley and Frank Gray Oval)**

0 10 20 30 40 50

Metres
Scale: 1:1,500 @ A3
*Coordinate System: GDA 1994 MGA Zone 56*

N

Biosis Pty Ltd

Albury, Ballarat, Melbourne,
Newcastle, Sydney, Wangaratta & Wollongong

*Matter: 30670*
*Date: 17 September 2019,*
*Checked by: MEH, Drawn by: AEDM, Last edited by: amurray*
*Location:P:\30600s\30670\Mapping*
*30670_F1_ProposedLightingPlan*

# 2 Methods

## 2.1 Literature and database review

Prior to completing the field investigation, information provided by Northern Beaches Council as well as other key information was reviewed, including:

- Review of current scientific literature on the ecological impacts of light pollution.
- Commonwealth Department of the Environment and Energy (DEE) Protected Matters Search Tool for matters protected by the EPBC Act.
- NSW Environment, Energy and Science (EES) BioNet Atlas of NSW Wildlife, for items listed under the BC Act.
- EES Vegetation Information System (VIS) mapping, including:
  - *The Native Vegetation of the Sydney Metropolitan Area* (OEH 2016)

The implications for the project were assessed in relation to key biodiversity legislation and policy including:

- *Environment Protection and Biodiversity Conservation Act 1999*
- *Environmental Planning and Assessment Act 1979*
- *Biodiversity Conservation Act 2016*
- *National Parks and Wildlife Act 1974*
- *Water Management Act 2000*
- *Warringah Local Environmental Plan 2011*
- *Warringah Development Control Plan 2011*
- State Environmental Planning Policy (Coastal Management) 2018

## 2.2 Field investigation

A field investigation of the study area was undertaken on 9 September 2019 by Matthew Hyde (Project Zoologist) of Biosis. The locations of the proposed six lighting towers were inspected and potential reflective areas contributing to light spill were assessed.

A habitat-based assessment was completed to determine the presence of suitable habitat for threatened species previously recorded (EES 2019) or predicted to occur (Commonwealth of Australia 2019) within 5 kilometres. This list was filtered according to species descriptions, life history, habitat preference and soil preference to determine those species most likely to be present within the study area.

# 3 Results

John Fisher Park consists of two maintained grass sport-fields (Frank Grey and Mike Pawley Oval) which border Greendale Creek (on the northern edge of the study area) which has been previously identified as known flyway for threatened microbats and a wildlife corridor for other fauna species under the Warringah DCP (2011).

The study area is bordered by Harbord Road to the west, which crosses Greendale Creek (first order strahler stream) in the northern edge of the study area. Each side of the riparian corridor consists of sporting fields, followed by low density residential. The study area is in close proximity to coastal areas with an alluvial landscape and has relatively low topographic relief. The lack of elevated terrain in the immediate vicinity of the study area indicates the lack of natural landscape features suitable for roosting cave-dwelling bats. Cave-dwelling species may utilise anthropogenic structures as roosting habitat in the form of culverts, bridges and disused structures.

No roosting habitat was identified within the study area, only foraging habitat within the riparian corridor of Greendale Creek (suited to edge-space foragers, cluttered foragers and trawlers) and open-space foraging habitat for species like Large Bentwing-bat, Little Bentwing-bat and Sheathtail bats in the oval areas.

The proposed lighting works will illuminate Mike Pawley and Frank Gray Oval of John Fisher Park and associated amenities. Light spill is likely to occur into the surrounding 'dark' areas of the riparian corridor north of the study area (Greendale Creek) unless mitigation measures are introduced.

### 3.1.1 Vegetation communities

The vegetation of the study area consists of one native vegetation community, PCT 1232 *Swamp Oak Floodplain swamp forest, Sydney Basin, Bioregion and South East Corner Bioregion* (Swamp Oak Floodplain Forest). This matches the vegetation community type mapped in The Native Vegetation of the Sydney Metropolitan Area (OEH 2016) (Figure 1). This community was located on the northern edges of Mike Pawley and Frank Gray Oval in the mapped wildlife corridor under the Warringah LEP. This matches the vegetation community type mapped in *The Native Vegetation of the Sydney Metropolitan Area* (OEH 2016). The vegetation community was confirmed based on the presence of the dominant upper stratum species Swamp Oak *Casuarina glauca*. The remainder of the study area consisted of Urban Native and Exotic vegetation.

### 3.1.2 Threatened species

Background searches identified records of threatened flora and fauna species recorded (EES 2019) or predicted to occur (Commonwealth of Australia 2019) within 5 kilometres of the study area. We understand that no removal of vegetation is required for the installation of the proposed lighting towers and as such further consideration of impacts to threatened flora species is not required.

Threatened fauna species considered most likely to have habitat within the study area based on the background research are as follows:

- Eastern Pygmy-possum *Cercartetus nanus* (Vulnerable, BC Act)
- Large Bent-winged Bat *Miniopterus orianae oceanensis* (Vulnerable, BC Act)
- Large-eared Pied Bat (Vulnerable, EPBC Act and BC Act)
- Little Bent-winged Bat *Miniopterus australis* (Vulnerable, BC Act)
- Barking Owl *Ninox connivens* (Vulnerable, BC act)

- Powerful Owl *Ninox strenua* (Vulnerable, BC Act)
- Sooty Owl *Tyto tenebricosa* (Vulnerable, BC Act)
- Greater Broad-nosed Bat *Scoteanax rueppellii* (Vulnerable BC Act)
- Grey-headed Flying-fox *Pteropus poliocephalus* (Vulnerable, EPBC Act and BC Act)
- Southern Brown Bandicoot (eastern) *Isoodon obesulus obesulus* (Endangered, EPBC and BC Act)
- Southern Myotis *Myotis macropus* (Vulnerable, BC Act)
- Spotted-tailed Quoll *Dasyurus maculatus* (Endangered, EPBC Act; Vulnerable, BC Act)

An assessment of the habitat values within the study area for each of these threatened fauna species, as well as an assessment of the likelihood of occurrence or impact from the proposed works, is provided in Table 1. Based on the size of the study area, the survey effort is considered comprehensive to assess the presence of potential habitat for the species.

**Table 1 Assessment of habitat for threatened fauna species**

| Species | Habitat association | Likelihood of occurrence or impact |
|---|---|---|
| **Eastern Pygmy-possum** | Eastern Pygmy Possum inhabits heathland, Banksia scrub and eucalypt forests along the south-east coast of Australia. The species is nocturnal, emerging at night to feed on nectar and pollen from flowering plants such as banksias and eucalypts, as well as some arthropods. They construct small spherical nests out of bark, often in tree hollows or beneath a loose layer of bark, where they shelter during the day.<br><br>Garrigal National Park, approximately 10 km west of the study area and the bushland west of Manly Vale (approximately 2.5 kilometres south-west of the study area) supports majority of the records for this species (EES 2019). | The study area and the vegetation along Greendale Creek lacks foraging and roosting resources for this species. Given the lack of available foraging resources, and no nearby hollows, the likelihood of occurrence for this species is low. Therefore, it is unlikely the proposed lighting of John Fisher Park would result in negative impacts to Eastern Pygmy-possum. Therefore, a Test of Significance (ToS) under the BC Act is not required. |

| Species | Habitat association | Likelihood of occurrence or impact |
|---|---|---|
| **Grey-headed Flying-fox** | Myrtaceous plant species are part of the documented diet for Grey-headed Flying Fox (Eby & Law 2008). Given the presence of feed trees in the vegetation surrounding John Fisher Park, the study area and surrounding locality is considered potential foraging habitat for Grey-headed Flying-fox.<br><br>The closest Grey-headed Flying-Fox camp is located approximately 3 km to the South-west of John Fisher Park along Burnt Bridge Creek in Balgowlah (Department of the Environment 2015). As such the study area and immediately locality is not considered as roosting habitat for the Grey-headed Flying-fox. | Given the proximity of the Balgowlah flying-fox camp to John Fisher Park, and the availability of foraging resources within the locality, there is a high likelihood Grey-headed Flying-fox occurs within the locality.<br><br>The Swamp Oak along the riparian corridor of Greendale Creek may provide intermittent roost sites during nightly foraging efforts. However, the primary roost site (camp) is located south of the study area in Balgowlah.<br><br>Impacts from the proposed lighting works are the potential for light spill to act as a deterrent to foraging Grey-headed Flying-fox within the locality. However, trials of bright lighting as a deterrent to foraging flying-foxes in fruit orchards have been found to be ineffective (Hall & Richards 2000). Whilst lights may initially act as a deterrent, individuals become accustomed to light and will feed in a fully illuminated orchard (Department of Primary Industries and Fisheries n.d.). Therefore, it is unlikely the proposed lighting of John Fisher Park would result in a negative impacts to Grey-headed Flying-fox. Therefore, a ToS under the BC Act and SIC assessment under the EPBC Act is not required. |
| **Southern Brown Bandicoot (eastern)** | Southern Brown Bandicoot is known to inhabit shrub and heath vegetation communities, particularly those with sandy soils and dense heathy vegetation in the lower stratum (Van Dyck & Strahan 2008). Garrigal National Park, approximately 10 km west of the study area supports a known population of the species (Department of the Environment 2019a). | The study area and the vegetation along Greendale Creek lacks foraging and nesting resources for this species. Given the lack of available habitat for this species, the likelihood of occurrence for this species is low. Therefore, it is unlikely the proposed lighting of John Fisher Park would result in a negative impacts to Southern Brown Bandicoot. Therefore, a ToS under the BC Act is not required. |

| Species | Habitat association | Likelihood of occurrence or impact |
|---|---|---|
| **Nocturnal birds** | Threatened owl records in the locality (5 kilometres radius) include:<br>• Powerful Owl *Ninox strenua*<br>• Barking Owl *Ninox connivens*<br>• Sooty Owl *Tyto tenebricosa*<br>Records for these owl species (with the exception of Powerful Owl) are largely concentrated towards the west of the study area in Garrigal National Park. Powerful Owl records are scattered throughout the residential areas of Curl Curl, Dee Why and Brookvale, which may indicate that the species is relatively accustomed to urban foraging. | Given the proximity of Powerful Owl records to John Fisher Park, and the potential foraging resources within the locality, there is a high likelihood Powerful Owl forages within the locality, on occasion. As for the other owl species, the probability of utilising the study area for foraging purposes is low due to limited foraging resources.<br><br>There is no specific research pertaining to artificial lighting impacts on these owl species. However, based on the species behavioural characteristics and secondary literature the following impacts may apply:<br>• Artificial lighting may reduce the abundance of prey species leading to a decline in foraging resources.<br>• Conversely, artificial lighting may also be utilised to attract certain prey.<br>• Potential behavioural adaption.<br><br>The study area does not support roosting habitat for theses owl species and therefore it is unlikely the proposed lighting of John Fisher Park will result in negative impacts to Powerful Owl, Barking Owl and Sooty Owl. Therefore, a ToS under the BC Act and Significant Impact Criteria (SIC) assessment under the EPBC Act is not required. |

| Species | Habitat association | Likelihood of occurrence or impact |
|---|---|---|
| **Foraging microbats** | Threatened microbat records in the locality (5 kilometres radius) include:<br>**Edge-space foragers (slow flyers that utilise gleaning and interception techniques)**<br>• Southern Myotis<br>• Large-eared Pied Bat<br>• Greater Broad-nosed Bat<br>Global studies, on edge-space foragers (i.e. Southern Myotis, Large-eared Pied Bat and Greater Broad-nosed Bat) have shown that they exhibit light avoidance behaviour in response to increased light (Black et al. 1994, McGuire & Fenton 2010, Patriarca & Debernardi 2010, Rowse, Harris, & Jones 2016).<br><br>**Open-space foragers (fast-flyers)**<br>• Little Bentwing-bat<br>• Large Bentwing-bat<br>Based on the morphological and behavioural characteristics of Large Bentwing-bat and Little Bentwing-Bat it is assumed that these species are likely to utilise artificial lighting for foraging purposes (Haddock et al. 2019).<br><br>44 records of Large Bentwing-bat within 600 metres of the study area, indicates that they species would utilise the study area and the Greendale Creek corridor for foraging. | Given the availability of potential foraging habitat within the riparian corridor of Greendale Creek, open-space foraging habitat, and the proximity of the recent records within the locality, there is potential for microbat species to be utilising the study area for foraging purposes. Furthermore, the network of culverts, bridges and other artificial structure located along Greendale Creek may provide nearby roosting habitat for the species.<br><br>Given that urban vegetation remnants are important for providing important foraging habitat for microbat species that require vegetated edges for intercepting prey (Gonsalves 2012, Clarke-Wood et al. 2016), the species that exhibit edge-space or trawling foraging characteristics are stipulated to be most susceptible to impacts resulting from anthropogenic lighting. Therefore, a ToS under the BC Act and SIC assessment under the EPBC Act has been prepared (Appendix 1). |

| Species | Habitat association | Likelihood of occurrence or impact |
|---|---|---|
| **Spotted-tail Quoll** | Spotted-tail Quoll are recorded in a wide range of habitats including the coastal heathland type vegetation found within the locality of the study area (Department of the Environment 2019b).<br><br>Spotted-tail Quolls are solitary animals requiring very large home ranges. Whilst some overlap in ranges can occur, females typically have a home range of between 180 and 1000 ha and males have a range of between 2000 and 5000 ha (Van Dyck & Strahan 2008). | As Spotted-tail Quolls require extensive home ranges, very large areas of habitat are likely to be required in order to support a viable population of the species (Glen & Dickman 2006). The last known nearby record (approximately 5 kilometres from the study area) was record in 1993 (26 years ago).<br>The native vegetation bordering John Fisher Park covers an area of approximately 10 ha and is effectively isolated from any other vegetation patches by residential development. As such, the study area and surrounding locality is not considered capable of sustaining a viable population of Spotted-tail Quoll and likelihood of occurrence and impacts are very low.<br>Therefore, a ToS under the BC Act and SIC assessment under the EPBC Act is not required. |

### 3.1.3 Migratory species

The impacts of artificial lighting at night (ALAN) on migratory bird species are well documented with birds being attracted to, and subsequently disorientated by, high intensity glare from communication towers, offshore oil platforms and other structures. Birds migrating at night can become 'trapped by the beam' of such lighting structures and subsequently die from direct collisions with structures, collisions with other birds, or through the excessive depletion of energy stores due to the disorientating effects of ALAN (Blackwell, DeVault, & Seamans 2015).

Migratory species are protected under the EPBC Act as one of the Matters of National Environmental Significance. Records for 47 migratory bird species included on the EPBC Migratory Species Lists exist within the vicinity of the proposed lighting works (Department of the Environment 2019c, Commonwealth of Australia 2019). It is likely that the proposed lighting installation will contribute to the cumulative light pollution escaping skywards from the Sydney metropolitan area. However, the cumulative level of ALAN from Sydney is already very high and the addition of the proposed sports-field lighting is unlikely to result in a significant increase of these lighting impacts on migratory birds. Mitigation measures recommended within this report will also help in reducing these potential impacts. As such further assessment of impacts to migratory bird species is not required.

# 4 Impact assessment and mitigation measures

## 4.1 Impact assessment

The proposed sportsground lighting works has the potential to have the following impacts on the surrounding environment if not appropriately addressed:

- Light spill into the 'dark' areas of the Greendale Creek vegetation corridor.
- Contributing to the cumulative artificial light pollution across the Sydney metropolitan area.
- Potential decrease in the abundance and diversity of bat species.
- Potential impacts to foraging habitat for Southern Myotis, which may lead to behavioural adaptions.
- Resource partitioning and shifts in foraging niches.
- Alterations to predator-prey species interactions.

BC Act ToS (Appendix 1) and EPBC Act SIC (Appendix 2) assessments have been undertaken to determine the significance of potential impacts to threatened fauna within the study area and surrounding locality. These assessments found no significant impacts are likely to occur for the threatened species with the potential to occur within the vicinity of the proposed works, provided the recommendations included in this assessment report are adopted to minimise light spill into the ecologically sensitive areas. These mitigation measures will also be of benefit to non-threatened fauna species that are also likely to be present within the riparian corridor of Greendale Creek, ensuring that any potential impacts on non-threatened fauna species in the area are also minimised.

### 4.1.1 Warringah Local Environmental Plan 2011

#### Land Use

The subject land is zoned RE1 - Public Recreation under the Warringah LEP. The objectives of this zone are:

- *To enable land to be used for public open space or recreational purposes.*
- *To provide a range of recreational settings and activities and compatible land uses.*
- *To protect and enhance the natural environment for recreational purposes.*
- *To protect, manage and restore public land that is of ecological, scientific, cultural or aesthetic value.*
- *To prevent development that could destroy, damage or otherwise have an adverse effect on those values*.

The proposed lighting installation will enable the land to be used by the public for recreational purposes for an extended period beyond daylight hours and therefore aligns with the objectives of its current zoning. With appropriate mitigation measures to protect the natural environment, the proposed lighting installation will address all objectives outlined by the LEP for public recreation.

### Acid Sulfate Soils

The study area is mapped as Class 4 Acid Sulfate Soils (ASS) under the Warringah LEP.

For Class 4 lands development consent is required for (LEP 2011):

- *Works more than 2 metres below the natural ground surface. Works by which the watertable is likely to be lowered more than 2 metres below the natural ground surface.*

## 4.1.2 Warringah Development Control Plan 2011

### E4 Wildlife Corridors

The objectives of this clause are:

- *To preserve and enhance the area's amenity, whilst protecting human life and property.*
- *To improve air quality, prevent soil erosion; assist in improving water quality, carbon sequestration, storm water retention, energy conservation and noise reduction.*
- *To provide natural habitat for local wildlife, maintain natural shade profiles and provide psychological & social benefits.*
- *To retain and enhance native vegetation and the ecological functions of wildlife corridors.*
- *To reconstruct habitat in non-vegetated areas of wildlife corridors that will sustain the ecological function of a wildlife corridor and that, as far as possible, represents the combination of plant species and vegetation structure of the original 1750 community.*

The requirements under the clause identify that for the modification of native vegetation where the area of land supporting the vegetation to be modified is greater than 50 $m^2$ or the land supporting the vegetation to be modified forms part of an allotment where vegetation has been modified in the last five years, the applicant must provide and Flora and Fauna Assessment with mitigation measures to fulfil the requirements of the clause.

### E5 Native Vegetation

The objectives of this clause are:

- *To preserve and enhance the area's amenity, whilst protecting human life and property.*
- *To improve air quality, prevent soil erosion, assist in improving water quality, carbon sequestration, storm water retention, energy conservation and noise reduction.*
- *To provide natural habitat for local wildlife, maintain natural shade profiles and provide psychological & social benefits.*
- *Promote the retention of native vegetation in parcels of a size, condition and configuration, which will as far as possible enable local plant and animal communities to survive in the long term.*
- *To maintain the amount, local occurrence and diversity of native vegetation in the area.*

The requirements under the clause identify that for the modification of native vegetation where the area of land supporting the vegetation to be modified is greater than 100 $m^2$ or the land supporting the vegetation to be modified forms part of an allotment where vegetation has been modified in the last five years, the applicant must provide and Flora and Fauna Assessment with mitigation measures to fulfil the requirements of the clause.

This assessment considers the potential impacts of the proposed lighting installation on the terrestrial biodiversity values within the locality of the works, and provides recommendations to mitigate these impacts. Assessment of significant impacts to EPBC Act and BC Act listed species have been conducted and, assuming the recommendations included in this report are adopted, no significant impact is likely to result from the proposed lighting installation. As such, this assessment addresses all requirements outlined in the Warringah Development Control Plan (DCP) 2011 for the removal/modification of native vegetation as well as activities that may impact the Wildlife Corridor (Greendale Creek riparian corridor).

### 4.1.3 State Environmental Planning Policy (Coastal Management) 2018

State Environmental Planning Policy (Coastal Management) (SEPP) 2018 aims to promote a co-ordinated approach to land use planning in the coastal zone of NSW in a manner consistent with the objects of the Coastal Management Act 2016 (CM Act). The eastern edge of study area is mapped as 'coastal environment area' under Division 3, Clause 13 of the SEPP, development consent must not be granted in an area mapped as a coastal environment area unless the consent authority has considered whether the proposed development is likely to cause an adverse impact on the following:

*(a) the integrity and resilience of the biophysical, hydrological (surface and groundwater) and ecological environment,*

*(b) coastal environmental values and natural coastal processes,*

*(c) the water quality of the marine estate (within the meaning of the Marine Estate Management Act 2014), in particular, the cumulative impacts of the proposed development on any of the sensitive coastal lakes identified in Schedule 1,*

*(d) marine vegetation, native vegetation and fauna and their habitats, undeveloped headlands and rock platforms,*

*(e) existing public open space and safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability,*

*(f) Aboriginal cultural heritage, practices and places,*

*(g) the use of the surf zone*.

*(2) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that:*

*(a) the development is designed, sited and will be managed to avoid an adverse impact referred to in subclause (1), or*

*(b) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or*

*(c) if that impact cannot be minimised—the development will be managed to mitigate that impact.*

Referring to the requirements outlined under Division 3, Clause 13 of the SEPP, the proposed lighting installation at John Fisher Park will not cause an adverse impact to any of the items listed in subclause (1). The assessment will provide mitigation measures for the proposed light installation to avoid and minimise impacts to areas mapped within the SEPP. Therefore, it is concluded that development consent can be granted in accordance with the SEPP.

### 4.1.4 *Water Management Act* 2000

The study area occurs adjacent to Greendale Creek a first order stream, which flows into Curl Curl Lagoon to the east. The proposed lighting installation is planned to occur within 40 metres from the top of bank of Greendale Creek. The proposed development will need to be the subject of a controlled activity permit in regards to the installation of lighting poles.

The proposed development will also need to address Clause E8 of the Warringah DCP, which applies to land identified as a 'waterways and riparian lands'.

Due to the setback of the proposed lighting poles being greater than 10 metres from the top of bank of

Greendale Creek, the preparation of a VMP for the entirety of the riparian corridor, within the site, is not recommended. The Natural Resource Access Regulator (NRAR) will assess the controlled activity permit application in regards to stormwater pipe installation.

## 4.2 Mitigation measures for artificial lighting

Potential mitigation measure for minimising the impacts of the proposed lighting installation are provided in Table 2. These measures have been largely adapted from Part 4 (good lighting design principles) of the NSW Department of Planning and Environment's *Dark Sky Planning Guideline* (2016).

**Table 2 Mitigation measure for lighting impacts for the proposed John Fisher Park sportfield lighting project**

| Mitigation measure | |
|---|---|
| **Eliminate upward light spill through directing lights downwards and installing shields** | Light spill that occurs above the horizontal plane of lighting fixtures contributes directly to artificial sky-glow. The upwards spilling of light can be minimised by:<br>• Installing light fitting shields with an opaque cover, mounted horizontally across the top of the lighting module. These shielding attachments allow only the downward projection of light.<br>• Direct lights downwards and avoid shining directly onto the public amenities, which have the potential to reflect light skywards.<br>• Utilise low beam angles that are close to vertical where possible to minimise light glare.<br>When light shines below the horizontal plan of a lighting fitting there is a dramatic reduction in the level of artificial sky-glow produced (Department of Planning and Environment 2016). |
| **Avoid over lighting** | • Lighting levels should be appropriate for the activity and adjusted depending on the type of sport and level of competition in accordance with the minimum lighting requirements of the AS2560 Sports lighting series and AS 4282: 2019 Control of the obtrusive effects of outdoor lighting.<br>• Lights should be switched off when not required. |
| **Consider use asymmetric beams** | • Consider use of asymmetric beams that permit horizontal glazing. These can be kept at or near parallel to the playing surface, minimising light spill.<br>• Asymmetric beam also allows the light modules to the mounted on the edge of the park, avoiding the need for fittings to be tilted upwards. |
| **Preferentially use lights along southern side of park for illumination** | • When programing light setups, preferentially use lights along the centre of the two ovals facing east and west, away from the main areas of the riparian corridor. |

# 5 Recommendations

Given there are potential impacts to native fauna resulting from light spill into the nearby Greendale Creek vegetation corridor, recommendations to minimise disturbance have been provided. Recommendations are also provided for implementation during the installation of the proposed lighting towers to minimise impacts to surrounding vegetation and habitats. These include:

- Lighting modules are to be fitted with shields to minimise light spill and pointed downwards to minimise contribution to sky-glow. It is acknowledged that some lighting may need to remain uncovered/angled skywards to allow for illumination during ball sports in accordance with AS 2560.2.3-2007 Sports lighting specific applications – Lighting for football (all codes). Use of these unshielded lights is to be minimised as much as possible.
- Lighting levels are to be adjusted to match minimum level of illuminance required for the sport and level of competition in play. Lighting should be programmed to meet these various requirements and switched off when not required.
- Consider implementing the other mitigation measures included in Table 2 to further reduce the impacts of light spill including:
  - Use of asymmetric beaming to minimise light spill.
  - Preferentially lighting with modules located in the centre of John Fisher Park facing away from the riparian corridor on the northern edge of the study area.
- During the installation of the lighting towers to the fullest extent practicable, minimise disturbance to any native vegetation surrounding the study area.
- Trees to be retained should be protected in accordance with Australian Standard AS4970 – 2009 Protection of trees on development sites, during construction, operation and decommissioning of the site compound as required.
- Soil transportation should be minimised within, into or out of the study area to reduce the spread of weeds.
- Appropriate erosion and sediment control measures should be installed to avoid indirect impacts to surrounding biodiversity values, including the nearby Greendale Creek vegetation corridor.
- A luminosity assessment should be undertaken following installation of the proposed lighting works to ensure consistency with the modelled lighting output and compliance with AS 4282 *Control of the Obtrusive Effects of Outdoor Lighting*. Assessment should include measures of luminous flux and illuminance under the different lighting setups required for the various types of sports and competition levels to ensure lighting levels do not exceed the minimum requirements.

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# Appendices

# Appendix 1 BC Act Tests of Significance

## Microbat species

Threatened microbat records (OEH BioNet 2019) in the locality (5 kilometres radius) include:

### Edge-space foragers (slow flyers that utilise gleaning and interception techniques)

- Southern Myotis (Vulnerable, BC Act).
- Large-eared Pied Bat *Chalinolobus dwyerii* (Vulnerable, BC Act and EPBC Act).
- Greater Broad-nosed Bat *Scoteanax rueppellii* (Vulnerable, BC Act).

### Open-space foragers (fast-flyers)

- Little Bentwing-bat *Miniopterus australis* (Vulnerable, BC Act).
- Large Bentwing-bat *Miniopterus orianae oceanensis* (Vulnerable, BC Act).

Based on the morphological and behavioural characteristics of Large Bentwing-bat and Little Bentwing-bat it is assumed that these species are likely to utilise artificial lighting for foraging purposes. The species are fast flyers that can be observed foraging above the canopy or low through grassy fields. Due to its agile and fast flight, it can intersect positive phototaxis (move towards the light) prey in open areas (i.e. beetles and flies) (Churchill 2008). The research undertaken by Haddock et al. 2019, further endorsed this positive response of Large Bentwing-bat to LED streetlights as the results showed a decrease to Gould's Wattled Bat *Chalinolobus gouldii* but not Large Bentwing-bat. The data suggests that the species is more influenced by seasonal and environmental variations.

Recent global studies have reported a negative association between bat activity and increased light pollution, specifically relating to the genus of Myotis. International research relevant to the Myotis genus have shown that this taxon have developed a behavioural adaption to avoid anthropogenic light (Black et al. 1994, McGuire and Fenton 2010, Patriarca and Debernardi 2010, Rowse et al. 2016). This behavioural adaption has been inherited to reduce the risk of predation and avoid potential adverse impacts on sensorial capabilities (Patriarca and Debernardi 2010). In America, *Myotis lucifugus* showed a drastic worsening in its ability to avoid large obstacles under artificial lighting conditions (McGuire and Fenton 2010). Furthermore, impaired flight response under artificial lighting conditions theoretically, would make the species more susceptible to predation and less effective during foraging efforts.

In broader terms, the research suggest that the impacts of artificial lighting on bats is highly dependent on taxonomical and morphological traits (i.e. physical characteristics and foraging guilds). Faster flying bats with longer wingspans (i.e. Freetail bats and Bentwing bats) would potentially utilise artificial lighting for foraging, whereas slower flyers with short-broader wings (i.e. Southern Myotis, Greater Broad-nosed Bat and Large-eared Pied Bat) that utilise cluttered and edge environments, tend to avoid artificial lighting (Rowse et al. 2016, Haddock et al. 2019). The potential impacts resulting from anthropogenic light pollution include:

- Increased resource partitioning (creating new foraging niches) (Rowse et al. 2016, Haddock et al. 2019).
- Behavioural adaptions (Black et al. 1994, McGuire and Fenton 2010, Patriarca and Debernardi 2010, Rowse et al. 2016).
- Reduced sensorial capabilities (McGuire and Fenton 2010).

- Long-term impacts to physiology (Patriarca and Debernardi 2010).
- Shifts in prey composition and an increase in phototaxis positive prey (Longcore and Rich 2004).
- Shifts in microbat species composition (Linley 2015, Rowse et al. 2016).
- Potential reduction in nightly foraging activity (Patriarca and Debernardi 2010, Haddock et al. 2019).
- Reduced predator avoidance (McGuire and Fenton 2010).
- Modification of regular flightpath (Patriarca and Debernardi 2010).
- Increased stress, which may lead to reduce population size or mortality (Rowse et al. 2016).
- Changes in trophic interactions (Longcore and Rich 2004).

Given that urban vegetation remnants are important for providing important foraging habitat for microbat species that require vegetated edges for intercepting prey (Gonsalves 2012, Clarke-Wood et al. 2016), the species that exhibit edge-space or trawling foraging characteristics are stipulated to be most susceptible to impacts resulting from anthropogenic lighting. Therefore, a Test of Significance (ToS) under the BC Act has been prepared.

In light of the assessment (questions a - e), the proposed lighting plan will not significantly impact potential foraging habitat for the microbats, provided the mitigation actions in Table 2 are implemented.

**The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats.**

***(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,***

Impacts likely to have an adverse effect on the life cycle of Southern Myotis, Greater Broad-nosed Bat, Large-eared Pied Bat, Little Bentwing-bat and Large Bentwing-bat, include direct mortality, loss or disturbance of roosting sites, clearing adjacent to foraging areas (i.e. decreased numbers of insects), application of pesticides in or adjacent to foraging areas, reduction in stream quality affecting food resources (specifically Southern Myotis) and predation by feral animals.

No roosting habitat, in the form of caves, culverts or hollow bearing, trees has been recorded in the study area, and will not be impacted by the proposed works.

The proposed lighting plan surrounding Mike Pawley and Frank Gray Oval, without mitigation measures may affect adjacent foraging habitat for Southern Myotis, Greater Broad-nosed Bat and Large-eared Pied Bat. Impacts resulting from uncontrolled light spill may provoke avoidance behaviour in these species and/or disorientation during flight. However, adjacent foraging habitats are available in areas within Curl Curl Lagoon (to the east) and Garrigal National Park (to the west).

Open-space foragers such as Little Bentwing-bat and Large Bentwing-bat have morphological traits which may provide the opportunity to benefit from increased artificial lighting. These faster-flying species (long wingspans) would potentially utilise artificial lighting for foraging in open spaces, targeting positive phototaxis prey (attracted to light). The research undertaken by Haddock et al. 2019, further endorsed this positive response of Bentwing-bats to LED streetlights.

Taking these factors into consideration it is unlikely that the installation of the proposed lighting, appropriately mitigated, would have an adverse effect on Southern Myotis, Greater Broad-nosed Bat, Large-

eared Pied Bat, Little Bentwing-bat and Large Bentwing-bat such that viable local populations would 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, not an ecological community.

***(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***

The proposed lighting plan without mitigation would potentially result in modification of foraging habitat for Southern Myotis, Greater Broad-nosed Bat, Large-eared Pied Bat, Little Bentwing-bat and Large Bentwing-bat. With the adoption of the mitigation measures, including eliminating upward light spill, aiming lights below the horizontal plane to avoid extended light attenuation and aiming lights away from the riparian corridor of Greendale Creek, the modification of habitat within the vicinity of Mike Pawley and Frank Gray Oval would not be significant.

Therefore, with mitigation measures foraging habitat for Southern Myotis, Greater Broad-nosed Bat, Large-eared Pied Bat, Little Bentwing-bat and Large Bentwing-bat will not be significantly modified by the lighting plan.

***(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***

The current foraging habitat within the study area is comprised of Swamp Oak Floodplain Forest along the northern edge of the study area. Additional habitat that is suitable for foraging are found in adjacent habitats along Curl Curl Lagoon, Dee Why Head, the adjacent reserves of John Fisher Park in North Curl Curl and further to the west in Garrigal National Park.

Unlit urban vegetation remnants (i.e. Greendale riparian corridor) are important refuge for maintaining bat diversity, particularly for more clutter-adapted and edge-space foraging species.

Provided the appropriate mitigation measures are followed in Table 2 of the report, primary foraging habitat used by Southern Myotis, Greater Broad-nosed Bat, Large-eared Pied Bat, Little Bentwing-bat and Large Bentwing-bat is unlikely to become fragmented as a result of the proposal.

***(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,***

Edge-space foraging habitat (Greendale Creek riparian corridor) will be indirectly impacted because of the proposed lighting installation (uncontrolled light spill), if not managed. The implementation of the mitigation measures will not isolate edge-space foraging habitat for Southern Myotis, Large-eared Pied Bat and Greater Broad-nosed Bat by maintaining 'dark' areas and consequently connectivity throughout the flyway.

Open-space foraging habitat will be directly impacted (Mike Pawley and Frank Gray), however, open-space foragers (Large Bentwing-bat and Little Bentwing-bat) do not exhibit light avoidance behaviour and have been documented utilising artificial lights for foraging purposes (Haddock et al. 2019).

The habitat within the study area is not considered important to the long-term survival of any these species (no confirmed roosting, breeding or maternal sites within or adjacent to the study area) and foraging habitat of similar quality is found further along the riparian corridor.

***(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),***

There are no declared areas of outstanding biodiversity value within the study area or locality. The proposed action will not affect declared areas of outstanding biodiversity value.

***(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 by the BC Act are relevant to the proposed light installation:

- Loss or disturbance of highly productive foraging sites.

The habitat features within the study area are not considered highly productive foraging habitat (some degree of urban encroachment). The vegetation bordering the study area provides some connection to adjacent habitat surrounding the study area for edge-space and clutter foragers. Furthermore, the mitigation measures intentions are to avoid light spill into the vegetation along the northern edge of the study area.

Therefore, the works will not result in the increase of a KPI for these threatened bat species, through the loss or direct disturbance of highly productive foraging sites.

**Conclusion**

In light of the consideration of the above five factors (a-e), the proposed activity is not likely to significantly impact Southern Myotis, Greater Broad-nosed Bat, Large-eared Pied Bat, Little Bentwing-bat and Large Bentwing-bat within the study area or wider locality, as:

- The proposed lighting plan with mitigation measures in place (Table 2), will not significantly impact potential foraging habitat for threatened microbat species. Other habitat features within the surrounds, provides foraging habitat for Southern Myotis, Greater Broad-nosed Bat, Large-eared Pied Bat, Little Bentwing-bat and Large Bentwing-bat.
- The proposed activity does not significantly contribute to the KTPs for these species.
- The proposed activity is not considered to adversely affect the lifecycle of these species.

Application of the Biodiversity Offset Scheme (BOS) or preparation of a Species Impact Statement (SIS) is therefore not required.

# Appendix 2 EPBC Act Significant Impact Criteria assessments

## Large-eared Pied Bat *Chalinolobus dwyerii*

Based on the proposed installation of lights at Mike Pawley Frank Gray Oval, the following SIC assessment outlines the potential impacts on Large-eared Pied Bat, in accordance with the EPBC Act.

Populations of Large-eared Pied Bat that may occur within the study area are not considered important populations due to the lack of suitable habitat for maternal roosts within the study area or in the nearby surrounds. Known breeding habitat occurs in the sandstone escarpments of the Sydney Basin and northwest slopes of New South Wales. According to the National Recovery Plan for Large-eared Pied Bat *Chalinolobus dwyeri* (DERM 2011), the species distribution and population sizes are still widely unknown.

The site contains foraging habitat within the vegetation corridor of Greendale Creek. The study area does not support roosting habitat for this species, however, the landscape features within Garrigal National Park provide suitable roosting habitat in the form of sandstone cliff-overhangs and karsts. There are nearby records of the species (within 3 kilometres; EES 2019), therefore a SIC assessment is required.

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

- **lead to a long-term decrease in the size of an important population of a species**

The *Important populations* of Large-eared Pied Bat are mainly restricted to sandstone escarpment areas of the Sydney Basin and northwest slopes of NSW and Moreton Bay National Park, however the species distribution and population sizes are still widely unknown. The study area is not located in an area currently classified as primary habitat for this species (DERM 2011). However, Garrigal National Park (west of the study area) would be mapped as important habitat due to recent species records (EES 2019) and suitable landscape features in the form of sandstone cliffs and outcrops.

No roosting habitat, in the form of caves, culverts or hollow bearing trees have been recorded in the study area, and will not be directly impacted by the proposed works. The proposed light installation will not result in the direct or indirect disturbance to potential habitat with the implementation of mitigation measures to shield the light from 'dark' areas in the northern portion of the study area. Habitat will remain available for movement of the species through the study area and the lighting plan is unlikely to lead to direct mortality.

Provided the recommended mitigation measures are followed, it is unlikely that the proposed action will lead to a long-term decrease in the size of the Large-eared Pied Bat population.

- **reduce the area of occupancy of an important population**

Large-eared Pied Bat distribution and population sizes are still largely unknown, further survey is required throughout its known range to determine the size and distribution of existing populations (DERM 2011).

The study area is underlain by sandstone, however the topographic relief is low and lacks elevated terrain for landscape features that are suitable for cave-dwelling bat species. The distribution and primary habitat of the species within the Sydney Basin is primarily confined to the network of sandstone cliffs (DERM 2011).

No roosting habitat, in the form of caves, culverts or hollow bearing trees has been recorded in the study area, and will not be directly impacted by the proposed works. The species may use the vegetation corridors on the northern edge of the study area on occasion, however, better quality habitat is found to the west in Garrigal National Park. The light attenuation will be controlled by implementing the mitigation measures in

the report and therefore the proposed activity will not reduce an area of occupancy of an important population.

- **fragment an existing important population into two or more populations**

As stated above, the proposed lighting installation is unlikely to directly affect habitat for the species (foraging habitat) provided the northern edge of the study area is shielded from increased light pollution. Therefore, the indirect disturbance associated with the light installation will not fragment an existing important population of Large-eared Pied Bat.

- **adversely affect habitat critical to the survival of a species**

The species is dependent on the presence of diurnal roosts for shelter. The roosts are utilised during torpor, raising young and for sheltering purposes when they are not foraging. The study area does not contain any habitat features suitable for roosting. No roosting habitat, in the form of caves, culverts or hollow bearing trees has been recorded in the study area, and will not be directly impacted by the proposed works.

The number of known breeding sites is limited. A maternity roost has been observed in a sandstone cave near Coonabarabran, and another nearby in the Pilliga sandstone (Pennay 2010). Any maternity roosts must be considered habitat critical to the survival of the species. The structure of maternity roosts for the species is very specific (high arched caves with a dome-shaped roof), this is so juvenile bats can learn to fly safely and for thermoregulation.

The study area provides marginal foraging habitat in the form of a vegetated riparian corridor. Provided the appropriate measures are followed (aiming light below the horizontal plane and away from the riparian corridor), there will be no impact to foraging habitat for Large-eared Pied Bat within the study area.

- **disrupt the breeding cycle of an important population**

The proposed activity will not affect an important population, the study area is not considered critical to the breeding cycles of an important population.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

No roosting habitat, in the form of caves, culverts or hollow bearing trees has been recorded in the study area, and will not be directly impacted by the proposed works. The indirect disturbance of potential habitat in the study area is not considered likely to modify, destroy, remove, isolate or decrease the availability of habitat to the extent that the species is likely to decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**

The proposed activity will not result in other invasive species that are harmful to a Large-eared Pied Bat becoming established at the study area.

- **introduce disease that may cause the species to decline, or**

The proposed activity will not introduce disease that may cause the species to decline.

- **interfere substantially with the recovery of the species**

The proposed activity will not interfere substantially with the recovery of the species.

**Conclusion**

Given the study area is not designated within an area of critical habitat for the species, it is highly unlikely that the proposal will significantly impact an important population of Large-eared Pied Bat.

The risks to Large-eared Pied Bat can be managed by implementing the mitigation measures in the report to avoid light spill into foraging areas. The above identified that the lifecycle and the long-term viability of Large-eared Pied Bat populations within the study area and will not be significantly impacted as a result of the proposed activity.

In light of the assessment, the proposed light installation will not result in a significant impact to Large-eared Pied Bat, and therefore referral to the minister is not required.