Barton Park Precinct – Green and Golden Bell Frog Management Plan

Bayside Council

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Template 2.8.1

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Abbreviations

Abbreviation	Description
BC Act	NSW *Biodiversity Conservation Act 2016*
BDAR	Biodiversity Development Assessment Report
CEMP	Construction Environmental Management Plan
DA	Development Application
DEC	Department of Environment and Conservation, now DPIE
DECC	Department of Environment and Climate Change, now DPIE
DotE	Department of the Environment, now Department of Agriculture, Water and the Environment
DPIE	NSW Department of Planning, Industry and Environment
ELA	Eco Logical Australia
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
GGBF MP	Green and Golden Bell Frog Management Plan
MNES	Matters of National Environment Significance
OEH	NSW Office of Environment & Heritage, now DPIE
PCT	Plant Community Type
SDS	Safety Data Sheets
SIS	Species Impact Statement
SREP	State Regional Environment Plan
WEMP	Wetlands Environmental Management Plan

1. Introduction

1.1. Project background

Eco Logical Australia Pty Ltd (ELA) was engaged by Bayside Council to prepare a Green and Golden Bell Frog Management Plan (GGBF MP) to support the proposed delivery of the Barton Park Precinct Masterplan. The overall objective of the Project is to provide an environmentally safe and accessible open space and recreational facility which in turn, will encourage people to be more physically and socially active and improve health outcomes and enhance the overall liveability of the Local Government Area (LGA).

Barton Park, located at 88-96 Bestic Street, Banksia to the west of Sydney Airport and 10 km south of the Sydney Central Business District, is currently utilised for active recreation. The proposed works will upgrade the outdated facilities of the park and provide amenities that meet the community's needs.

Generally, the works proposed will consist of:

- Four sporting fields
- Four tennis courts
- Two multi-use courts
- Training field
- Play space
- A grandstand
- Four carparks (totally approximately 241 car spaces)
- Football and tennis clubhouses and amenities
- Fitness park
- Walking / cycling pathways
- Other associated infrastructure.

The Project is subject to two approval pathways, being:

1. A local Development Application (DA) under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the construction of the proposed grandstand, with Bayside Council as the approval authority and assessed within a Statement of Environmental Effects (SoEE)
2. An activity under Part 5 of the EP&A Act for all other works, with Bayside Council as the determining authority and assessed within a Review of Environmental Factors (REF).

Adjacent to the Masterplan boundary is Landing Lights Wetland, a unique wetland environment that provides habitat for federal and state-listed threatened species, including migratory birds. This GGBF MP has been prepared to facilitate the management of the *Litoria aurea* (Green and Golden Bell Frog) within the Landing Lights Wetland. A separate Wetland Environmental Management Plan (WEMP) has been prepared to facilitate the ongoing protection and enhancement of the Landing Lights Wetland and riparian habitat alongside Muddy Creek, during the construction and operational phases of the Barton Park Precinct Masterplan works (ELA 2021a).

1.2. Green and Golden Bell Frog within Barton Park

Habitat for the Green and Golden Bell Frog is present within the Landing Lights Wetland at Barton Park and would not be directly impacted by the proposed upgrade works (Figure 1 and Figure 2). A 20 m vegetated buffer has been included in the Masterplan to lessen indirect impacts to Green and Golden Bell Frog habitat. The size of this buffer was selected because it coincides with existing native vegetation surrounding the wetland (Figure 3). It is not practical to widen this 20 m buffer given that land beyond it has previously been developed and is largely cleared.

The Landing Lights Wetlands is within the Management Area as displayed in Figure 1. The area would also be managed under the WEMP (ELA 2021a).

Green and Golden Bell Frog have previously been recorded within Barton Park (AMBS Ecology & Heritage 2020, AMBS Ecology & Heritage 2021, Department of Planning, Industry and Environment (DPIE) 2021). The results of surveys undertaken by AMBS Ecology & Heritage for Transport for NSW (2021) are presented in Figure 4. BioNet records of Green and Golden Bell Frog within Barton Park and surrounds are presented in Figure 5.

Assessments of significance in accordance with the NSW *Biodiversity Conservation Act 2016* (BC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were undertaken to assess the impact of the proposed works on Green and Golden Bell Frog (ELA 2021b). Assessments concluded that the proposed works are unlikely to result in a significant impact on the species. Assessments are presented in full in the Flora and Fauna Assessment prepared by ELA (2021b) for the Barton Park Precinct Masterplan.

1.3. Purpose of the Management Plan

This GGBF MP has been prepared to support the State environmental approvals process. In accordance with Clause 17(5) of the Cooks Cover Sydney Regional Environmental Plan (SREP), this GGBF MP must identify the location of existing and proposed Green and Golden Bell Frog habitats, including areas considered to be significant, and include proposals covering the following—

a. *protection of the Green and Golden Bell Frog,*
b. *protection of the Green and Golden Bell Frog habitat,*
c. *how existing and proposed wetlands relate to protection of the Green and Golden Bell Frog and its habitat,*
d. *how stormwater management processes relate to protection of the Green and Golden Bell Frog and its habitat,*
e. *how development and management of the golf course* (Note: the golf course is now a playing ground) *and open space areas, management of public access and proposed development within the Trade and Technology Zone relate to protection of the Green and Golden Bell Frog and its habitat,*
f. *management of the direct and indirect impacts of the proposed development on the protection of the Green and Golden Bell Frog and its habitat,*
g. *measures to mitigate adverse environmental impacts of the proposed development, including habitat enhancement and the provision of compensatory habitat for the Green and Golden Bell Frog,*

h. measures to appropriately manage habitat areas in both the short and long term.

This GGBF MP has been considered in relation to available legislation and related documents outlined in Section 0.

1.4. Objectives of this Plan

This GGBF MP has the following objectives:

- To mitigate and manage potential indirect impacts to Green and Golden Bell Frog and their habitat within Barton Park during construction works
- To enhance the habitat for Green and Golden Bell Frog within the Management Area
- To protect the population of Green and Golden Bell Frog occurring within the Landing Lights Wetland throughout the life of the Barton Park Precinct project
- To support existing Green and Golden Bell Frog Management Plans for the Arncliffe population by providing site-specific mitigation and management measures for the Barton Park Precinct.

1.5. Key terms

The following terminology is used throughout this GGBF MP and displayed in Figure 1:

- **Barton Park** refers to 88-96 Bestic Street, Banksia (Lot 100 DP 1228008, Lot 1 DP 576148 and Road Reserve)
- **Works footprint** refers to areas of Barton Park in which construction and fill and capping are proposed
- **Management Area** refers to the area in Barton Park to which this GGBF MP applies. It includes the Landing Lights Wetland and surrounding native vegetation which would not be removed as part of the Barton Park Precinct redevelopment.

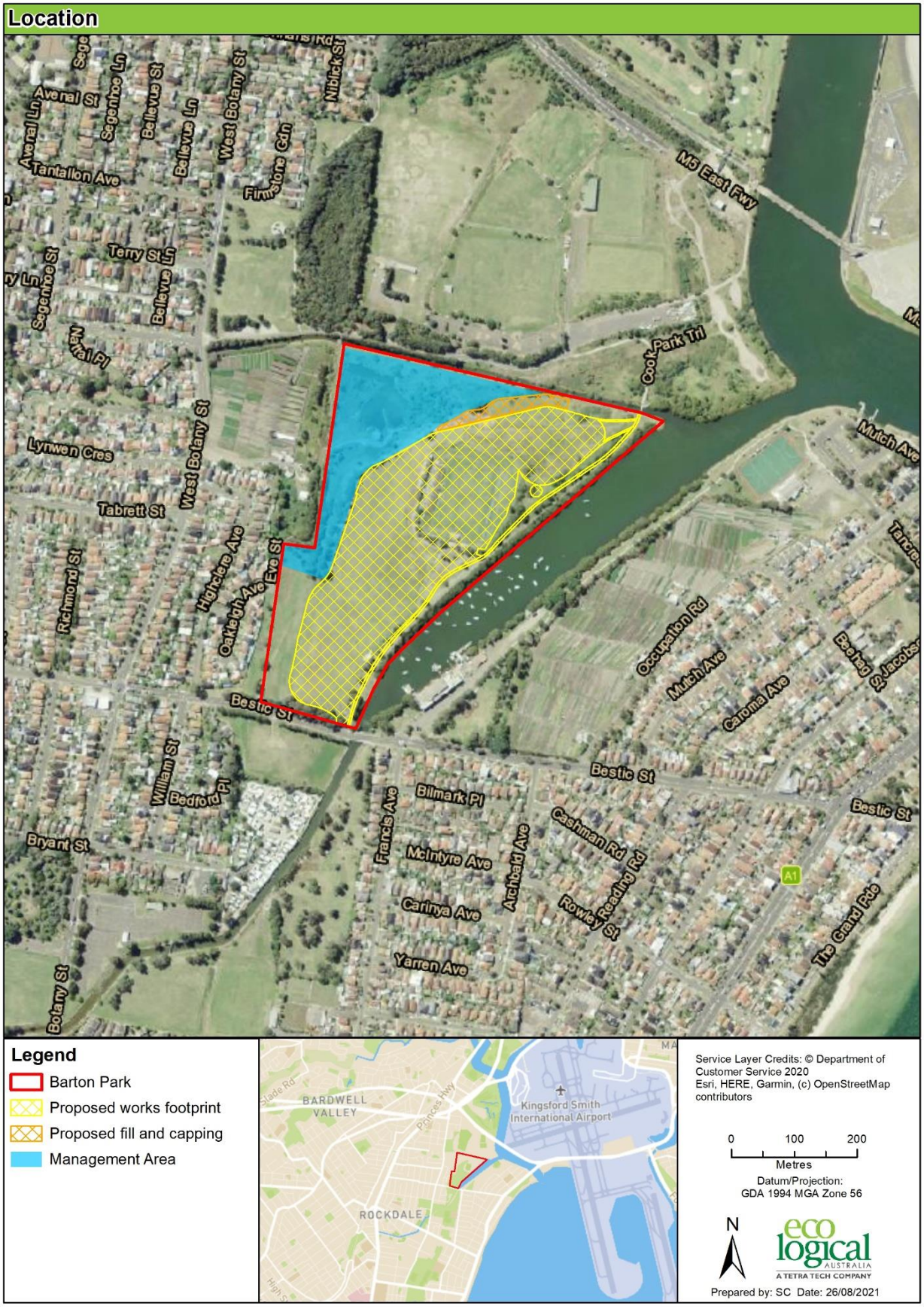

Figure 1: Map of Green and Golden Bell Frog habitat within Barton Park

Figure 2: Green and Golden Bell Frog habitat

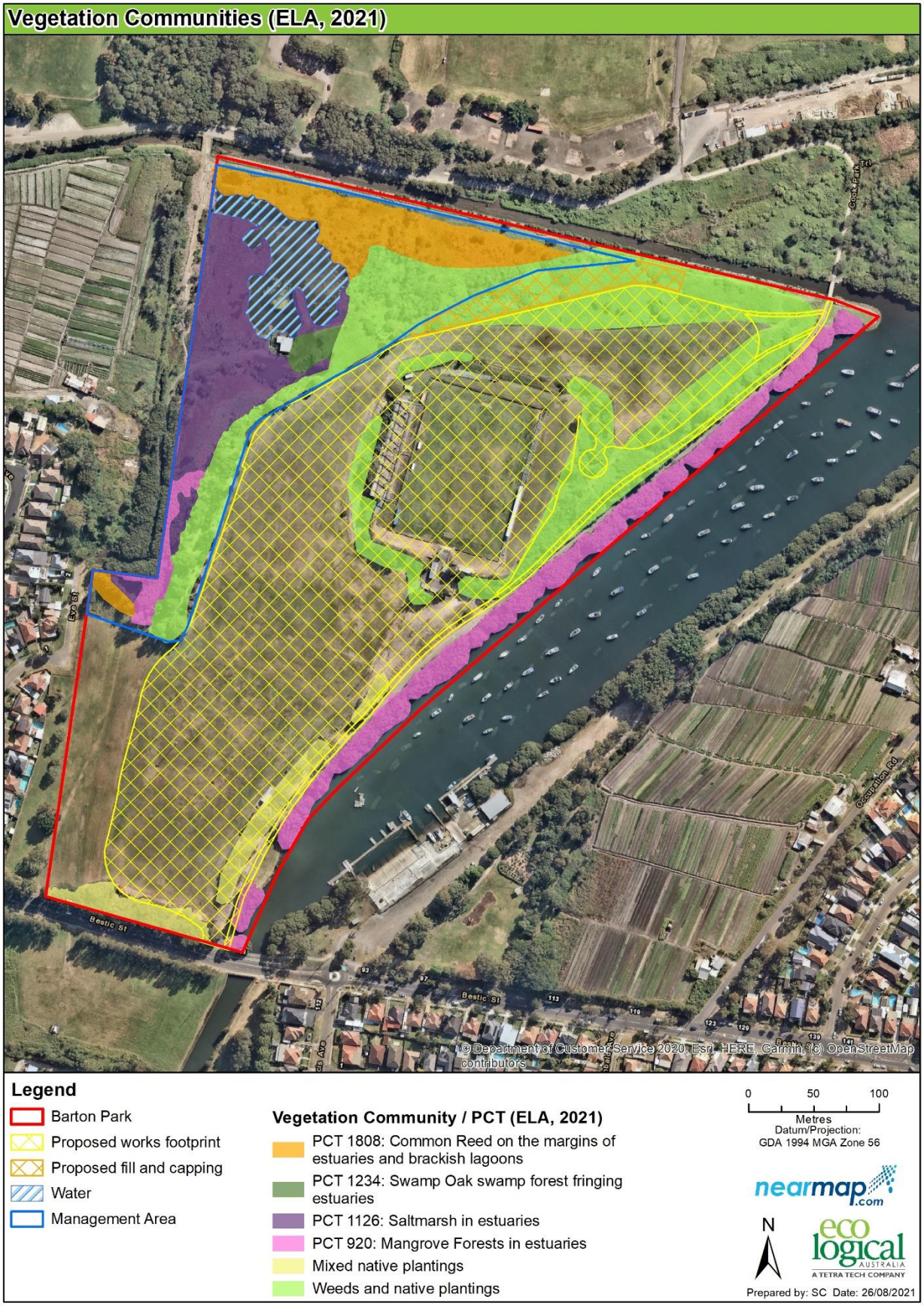

Figure 3: Validated vegetation communities within Barton Park ('subject land') (ELA 20201b)

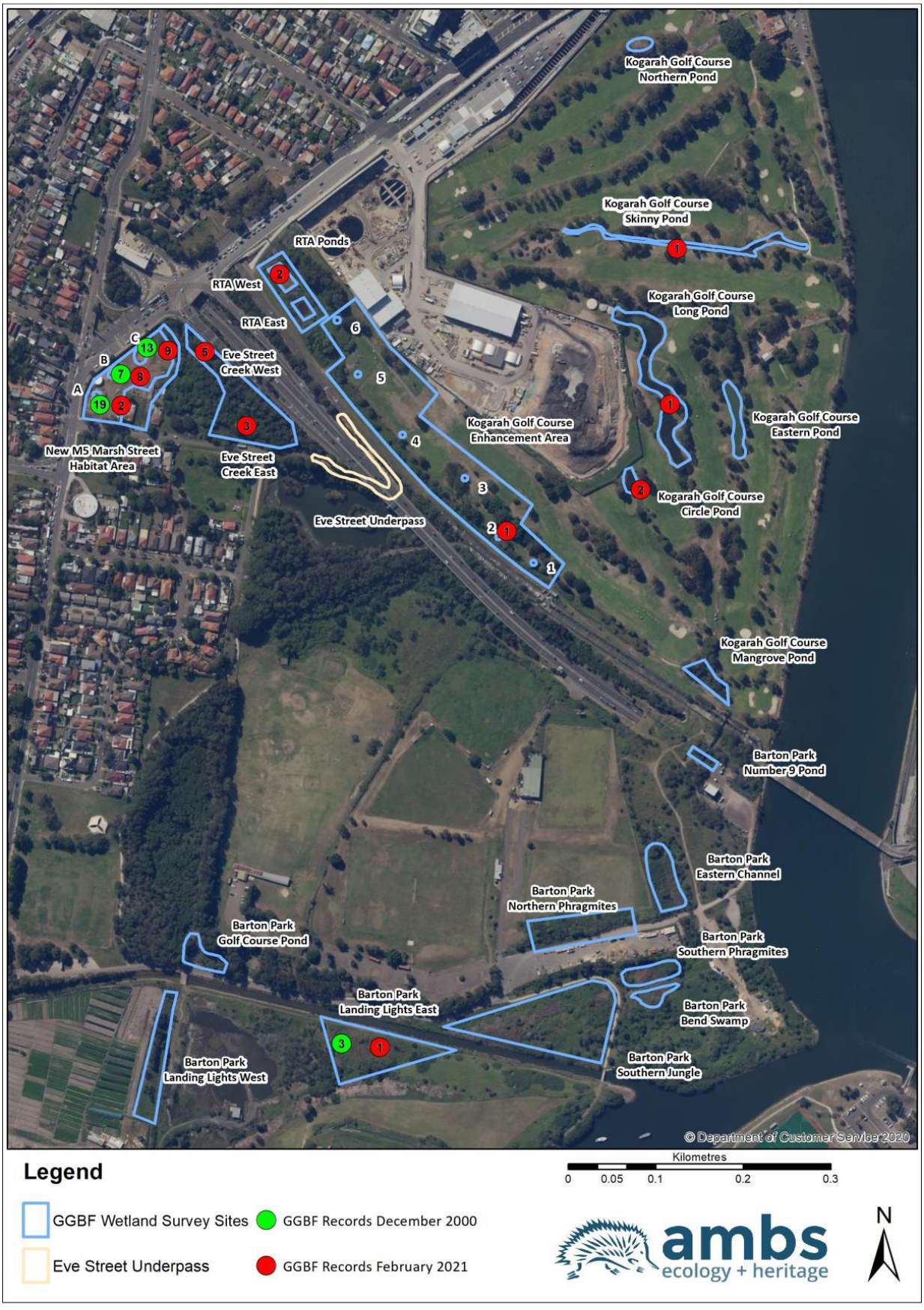

Figure 4: Green and Golden Bell Frog records from surveys undertaken by AMBS Ecology & Heritage (2021)

Figure 5: BioNet records for Green and Golden Bell Frog (DPIE 2021)

2. Legislative context and related documents

2.1. Legislative context

Legislation relevant to this GGBF MP is presented in Table 1.

Table 1: Legislative context

Name	Relevance to the project	Report Section (if relevant)
	Commonwealth	
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	The Green and Golden Bell Frog is listed as vulnerable under the EPBC Act. The EPBC Act protects Matters of National Environment Significance (MNES), including threatened species. The EPBC Act establishes a process for assessing the environmental impact of activities and developments where MNES may be affected. Significant Impact Criteria in accordance with the EPBC Act and Significant Impact Guidelines 1.1 (Commonwealth of Australia 2013) were applied to assess the impact of the proposed works on Green and Golden Bell Frog and are presented in the Flora and Fauna Assessment prepared by ELA (2021b) for the Barton Park Precinct Masterplan. It was concluded that the proposed works are unlikely to result in a significant impact on the species.	-
	State	
Biodiversity Conservation Act 2016 (BC Act)	The Green and Golden Bell Frog is listed as endangered under Schedule 1 of the BC Act. If a species, population, or ecological community listed under Schedules 1 or 2 of the BC Act is likely to be impacted, the factors set out to establish if there is likely to be a significant impact on that species, population, ecological community or habitat, must be assessed. Section 7.3 of the BC Act sets out five factors that must be addressed as part of a Test of Significance. A Test of Significance in accordance with the BC Act was undertaken to assess the impact of the proposed works on Green and Golden Bell Frog and is presented in the Flora and Fauna Assessment for the Barton Park Precinct Masterplan (ELA 2021b). It was concluded that the proposed works are unlikely to result in a significant impact on the species.	-
	Planning Instruments and Other Plans	
Sydney Regional Environmental Plan 33– Cooks Cove (Cooks Cove SREP)	Barton Park is located within the Cooks Cove site as defined by the Cooks Cove SREP. The Cooks Cover SREP does not apply to Part 5 activities listed under the *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP), such as the Barton Park Precinct Masterplan. However, the SREP does apply to the proposed Grandstand DA. In accordance with Clause 17(1) to the SREP, consent must not be granted for any development on land within the Cooks Cove site until after the consent authority has taken into consideration a Green and GGBF MP. The GGBF MP must be served to the Director-General of the Department of Environment and Conservation (now DPIE) and updated following written comments from DPIE within 40 days after the date of service.	Entire report

2.2. State Regional Environment Plan No 33 - Cooks Cove

The requirements of a GGBF MP in accordance with Clause 17(5) of the Cooks Cove SREP and their relevant section(s) in this GGBF MP are presented in Table 2 below.

Table 2: Compliance with Cooks Cove SREP

Clause 17(5)	Relevant plan section
a. protection of the Green and Golden Bell Frog,	Sections 5 and 6
b. protection of the Green and Golden Bell Frog habitat,	Sections 5 and 6
c. how existing and proposed wetlands relate to protection of the Green and Golden Bell Frog and its habitat,	Section 1.2
d. how stormwater management processes relate to protection of the Green and Golden Bell Frog and its habitat,	Section 5
e. how development and management of the golf course and open space areas, management of public access and proposed development within the Trade and Technology Zone relate to protection of the Green and Golden Bell Frog and its habitat,	Sections 4, 5 and 6
f. management of the direct and indirect impacts of the proposed development on the protection of the Green and Golden Bell Frog and its habitat,	Sections 4, 5 and 6
g. measures to mitigate adverse environmental impacts of the proposed development, including habitat enhancement and the provision of compensatory habitat for the Green and Golden Bell Frog,	Sections 4, 5 and 6
h. measures to appropriately manage habitat areas in both the short and long term.	Sections 4, 5 and 6

2.3. Related Documents

This GGBF MP has been prepared in consideration of the following relevant documents:

- Approved Conservation Advice for *Litoria aurea* (Green and Golden Bell Frog) (Department of the Environment (DotE) 2014)
- Draft Recovery Plan for the Green and Golden Bell Frog (Department of Environment and Conservation (DEC) 2005)
- Plan of Management – Green and Golden Bell Frog Key Population of the Lower Cooks River (Department of Environment and Climate Change (DECC) 2008a)
- EPBC Act Policy Statement 3.19. Significant Impact Guidelines for the vulnerable Green and Golden Bell Frog *Litoria aurea* (Commonwealth of Australia 2009)
- Best Practice Green and Golden Bell Frog Habitat Guide (DECC 2008b)
- Protecting and restoring Green and Golden Bell Frog habitat (DECC 2008c)
- Hygiene guidelines for Wildlife (DPIE 2020a)
- Green and Golden Bell Frog Plan of Management – Arncliffe (ELA 2017)
- Cook Cove Southern Precinct Development Application – Green and Golden Bell Frog Management Plan (Cumberland Ecology 2016)
- Green and Golden Bell Frog Monitoring – Arncliffe December 2020 - February 2021 (AMBS Ecology and Heritage 2021)
- Green and Golden Bell Frog Monitoring – Arncliffe September 2020 - November 2020 (AMBS Ecology and Heritage 2020)

- Barton Park Precinct - Wetland Environmental Management Plan (ELA 2021a)
- Barton Park Precinct – Flora and Fauna Assessment (ELA 2021b)
- Barton Park Precinct – Review of Environmental Factors (ELA 2021c).

3. Green and Golden Bell Frog

3.1. Description

The Green and Golden Bell Frog is a relatively large dull olive to bright emerald, green frog that can range in size from around 45 millimetres to 100 millimetres snout to vent length (Cogger 2000) (Figure 6). Its common name arises from the fact that typically the dorsal surface is green with bronze-gold spots and marbling to varying degrees, although the dorsum can be almost entirely green. Its other distinctive characteristics are a gold or creamish white dorso-lateral stripe running along the top side of the body, extending from the upper eyelids almost to the groin, with a narrow dark brown stripe beneath it, from nostril to eye. It also has a blue or bluish-green colour on the inside of the thighs (OEH 2015). The Green and Golden Bell Frog can be distinguished from similar species by its wart-free skin, expanded finger and toe pads, and lack of spotting or marbling on the hind side of the thigh. Tadpoles of the species are relatively large (65 – 100 millimetres at limb bud development stage) and juvenile frogs are smaller versions of the adults that metamorphose at around 25 – 30 millimetres snout to vent length (DEC 2005).

It is active by day as well and at night and usually breeds in summer when conditions are warm. However, breeding has been recorded from September to March, with a peak breeding period following heavy rains in the warmer January to February months. Breeding patterns are influenced by geography with southerly and higher altitude populations having a narrower window of opportunity for breeding than more northerly and lower altitude populations (DEC 2005, DotE 2014).

The species is known to be highly mobile, often travelling a few hundred metres to reach a breeding site and less for everyday activities (F. Lemckert, personal communication, August 2021). However, in rare occasions they may travel up to 1-1.5 km in a single day/night between breeding sites (Pyke and White 2001). Male frogs call while floating in water and amongst fringing vegetation and females produce a raft of eggs that initially float before settling to the bottom of the water body (DEC 2005). Tadpoles are known to feed on algae and other plant-matter within the water body, while adult frogs are known to eat mainly insects, but will eat smaller vertebrates including other frogs.

Figure 6: Green and Golden Bell Frog (ELA 2017)

3.2. Habitat

Green and Golden Bell Frogs can occupy a broad range of habitats, including natural, artificial and disturbed habitats, and breed in ephemeral and permanent ponds (Pyke & White 1996, DEC 2005). Green and Golden Bell Frogs need various habitats for different aspects of their life cycle including foraging, breeding, sheltering, over-wintering and dispersal. They have been recorded associated with coastal swamps, marshes, dune swales, lagoons, lakes and other estuarine wetlands as well as riverine floodplain wetlands and billabongs. They are also well known for breeding in constructed water bodies such as storm water detention basins, farm dams, bunded areas, drains and ditches (DEC 2005). They will use these different habitats or habitat components on a temporal or seasonal basis (DotE 2014).

Emergent vegetation, including *Typha* spp. (Bullrushes) or *Eleocharis* spp. (Spikerushes), is a key element of Green and Golden Bell Frog habitat (F. Lemckert, personal communication, August 2021). Emergent vegetation is used for shelter and to provide safe basking locations. Dense vegetation also assists tadpoles avoid predators, including *Gambusia holbrooki* (Plague Minnow). Vegetation is an important element as it has a big determination as to the quality of a water body as a potential breeding site. The species is not known to use barren water bodies.

Breeding habitat consists of water bodies that are still, shallow, ephemeral, unpolluted, unshaded, with aquatic plants present and free of *Gambusia holbrooki* (Plague Minnow) and other predatory fish. Breeding habitats also occur near terrestrial habitats containing grassy areas and vegetation for foraging and dispersal, and a range of diurnal shelter sites, such as rocks, logs, tussock forming vegetation and other cover for refuge (Pyke & White 1996, DotE 2014).

3.3. Distribution

The Green and Golden Bell Frog has declined from a status where it was regarded as an extremely abundant species, with a widespread and almost continuous distribution between the north coast near Brunswick Heads, south along the coast to Victoria, to one where it now has only a fragmented distribution throughout this former range (DEC 2005). It is currently considered to be absent from at least 90% of its former distribution (White and Pyke 1996, DEC 2005).

The Green and Golden Bell Frog now occurs mainly along the coastal lowland areas of eastern NSW and Victoria with a disjointed distribution extending from Yuraygir National Park near Grafton on the North Coast of NSW, to the vicinity of Lake Wellington, just west of Lakes Entrance in south-eastern Victoria (DotE 2014). The furthest extant inland record of the species is near Hoskinstown in the Southern Tablelands, just outside the ACT (DotE 2014).

At the time of the Draft Recovery Plan production (DEC 2005), there were 43 populations described as 'key' populations, known or considered likely to persist throughout the species range within NSW. The number of populations now extant is significantly less, with a number of the Sydney and Hunter Valley populations now being apparently extinct (Mahony et al. 2013).

3.4. Arncliffe Key Population

As part of the original M5 East project opened in 2001, Roads and Maritime provided breeding ponds for the Green and Golden Bell Frog on Roads and Maritime owned land occupied by Kogarah Golf Club in Arncliffe, known as the RTA ponds. The RTA Ponds were purpose built and while they are permanent,

they have the capability of being periodically emptied. Water levels are managed in response to particular triggers and in accordance with the "Management Plan for the Green and Golden Bell Frogs (*Litoria aurea*) at Arncliffe" (White 1998) prepared as part of the M5 East approval. Draining habitat ponds allows for the control of the plague Minnow and also for removing aquatic vegetation if it gets too dense (F. Lemckert, personal communication, August 2021).

The two ponds were planted with emerging and fringing aquatic vegetation such as *Eleocharis* sp. and *Schoenoplectus* sp. These species are rushes and sedges which are used by the frogs for basking. The areas surrounding the ponds were planted with native grasses such as *Rytidosperma* sp. (Wallaby Grass) and a few low shrubs. No trees were planted at these shade the ponds, which can be less favourable for the frogs if shading becomes too great. A boulder field was constructed to provide basking or sheltering habitat. The entire site was fenced with cyclone mesh fencing to prevent access to the ponds. Maintenance of the RTA ponds is managed by the Roads and Maritime M5 East asset team in consultation with Dr Arthur White. Assistance is also provided by the Frog and Tadpole Study Group when required.

Formal monitoring of the frogs in the area started in November 2000 and has continued as recently as February 2021 (AMBS Ecology and Heritage 2021). Monitoring areas in Barton Park and surrounds are shown in Figure 4

3.5. Key threatening processes

The Draft Recovery Plan for the species (DEC 2005) identifies the following Key Threatening Processes relevant to the decline of Green and Golden Bell Frogs:

- Predation by the Plague Minnow (*Gambusia holbrooki*)
- Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands
- Infection of frogs by amphibian chytrid causing the disease chytridiomycosis
- Clearing of native vegetation
- Predation of the European Red Fox.

In addition to the above, the approved Conservation Advice for the species (DotE 2014) also identifies the following as main threats:

- Changes to the structure and diversity of aquatic vegetation
- Changes to water quality (pollution, herbicide run-off, siltation, erosion and changes to timing and duration of flood events)
- Intensification of public access to habitat.

3.5.1. Amphibian chytrid fungus

The following information is taken from the NSW Hygiene Guidelines (DPIE 2020a):

> *"Batrachochytrium dendrobatidis (Amphibian chytrid fungus) is a fungal pathogen that causes the disease chytridiomycosis, which has led to the decline and extinction of frog populations globally and in Australia (Office of Environment & Heritage (OEH) 2018). Chytridiomycosis has*

been detected in over 40 species of native Australian frogs (DECC 2008d), including the Green and Golden Bell Frog. The fungus is transferred by direct contact between frogs and tadpoles or via zoospores in infected water (OEH 2018). Humans can spread the disease by contaminated footwear and equipment and by (illegally) moving frogs from one area to another. Batrachochytrium dendrobatidis is listed as prohibited matter under the Biosecurity Act 2015. Consequently, it is an offence to knowingly spread chytrid."

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4. Impacts to Green and Golden Bell Frog habitat

The following section discusses the potential impacts to Green and Golden Bell Frog resulting from the proposed upgrades at Barton Park, including the Barton Park Masterplan and Grandstand. A full impact assessment in relation to biodiversity values is detailed in a separate Flora and Fauna Assessment (ELA 2021b) and outlined, along with impact assessments for other environmental factors, in a separate REF (ELA 2021c).

4.1. Direct impacts to Green and Golden Bell Frog Habitat Avoided

The design of the Barton Park Precinct Masterplan has avoided direct impacts to the Landing Lights Wetland by locating the proposed works footprint on cleared land or vegetation identified as 'mixed native plantings' or 'weeds and native plantings' (Figure 3). The design also includes a 20 m vegetated buffer between the edge of Landing Lights Wetland and the footprint, which is made up of the following native plant community types (PCTs):

- **PCT 920**: Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion (Estuarine Mangrove Forest)
- **PCT 1126**: Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion (Estuarine Saltmarsh)
- **PCT 1234**: Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion (Estuarine Swamp Oak Forest)
- **PCT 1808**: Common Reed on the margins of estuaries and brackish lagoons along the New South Wales coastline (Estuarine Reedland).

Remediation of contaminated land at the edge of the wetland is proposed as part of the development and further measures to protect the wetland form part of the WEMP (ELA 2021a).

4.2. Potential Direct Impacts

Unless mitigated, the proposed upgrades could have the following direct impact on Green and Golden Bell Frogs during construction:

- Mortality or injury of individuals as a result of construction activities.

4.3. Potential Indirect Impacts

Unless mitigated, the proposed upgrades could have the following indirect impacts on Green and Golden Bell Frogs during construction:

- Increase in dust from heavy machinery movements
- Increase in noise by heavy machinery movements
- Increase in vibration from heavy machinery movements
- Increase in artificial light from construction operations extending past daylight hours
- Accidental introduction of predatory fish, Plague Minnow

- Accidental introduction of amphibian chytrid fungus by construction personnel, equipment or machinery
- Reduction of water quality in Landing Lights Wetland through sediment-laden flow and/or contaminants originating from construction areas.

Potential indirect impacts related to increased dust, noise and vibration resulting from the proposed constructions works are detailed in the REF prepared for the Masterplan (ELA 2021a). The REF also includes mitigation measures for these indirect impacts, which when implemented would minimise the potential for indirect impacts to Green and Golden Bell Frog habitat.

Unless mitigated, the proposed upgrades could also have the following indirect impacts on Green and Golden Bell Frogs resulting from post-construction stages, i.e., the operation and maintenance of the Barton Park Precinct as an area for active recreation and open space:

- Increase in noise by Precinct users
- Increase in artificial lighting from Precinct
- Accidental introduction of Plague Minnow
- Accidental introduction of amphibian chytrid fungus by Precinct users or maintenance personnel, equipment or machinery
- Reduction of water quality in Landing Lights Wetland through sediment-laden flow and/or contaminants originating from Precinct areas.

Mitigation and management measures to address the above impacts are provided in Section 5.

5. Mitigation and Management Measures

Bayside Council is seeking to manage impacts to Green and Golden Bell Frog habitat located in Barton Park through the implementation of mitigation and management measures set out in this GGBF MP. Where relevant, these measures are to be incorporated into the Construction Environmental Management Plan (CEMP) for works associated with both the Barton Park Masterplan and Grandstand. The measures are to be implemented by the Construction Contractor and Bayside Council (in consultation with a Project Herpetologist).

5.1. Construction Mitigation and Management Measures

Management measures relating to construction activities associated with the Barton Park Masterplan and Grandstand are outlined in Table 3. These measures should be considered as a minimum requirement and implementation is the responsibility of the Construction Contractor, Bayside Council and/or the Project Herpetologist as listed in the table below.

Table 3: Construction mitigation and management measures

Measure	Action	Outcome	Timing	Responsibility
Define the construction clearing areas	Clear delineation of the works footprint. Areas to be cleared should be marked and checked with surveyor's pegs and equipment to ensure that the minimum area of take is adopted. Clearing should only occur within these areas. Once areas are cleared, the area of take should be calculated to ensure that no additional areas have been cleared. The distance between the edge of the Landing Lights Wetland and the edge of the clearing required for the construction zone is expected to be at least 20 m.	Accidental clearing resulting in direct impacts to Green and Golden Bell Frog habitat avoided	Prior to commencement and throughout construction works	Construction Contractor
Establish a frog exclusion zone	Establishment of a physical barrier, using frog exclusion fencing between the Landing Lights Wetland and works footprint. This frog fencing should be designed in consultation with a person who has had at least five years' experience in the management of Green and Golden Bell Frogs (Project Herpetologist). Frog-exclusion fences have been used routinely on construction sites and other hazardous areas where threatened frog species occur. Frog exclusion	Exclusion of humans from entering frog habitat Exclusion of frogs from entering construction	Prior to commencement and weekly during construction works	Construction Contractor Project Herpetologist

Measure	Action	Outcome	Timing	Responsibility
	fences generally consist of a continuous curtain of impervious and relatively non-climbable material (usually shade cloth fabric) strung between support posts. The fence is at least 1 m high and has an overhanging outer lip. The overhanging lip is designed to prevent frogs climbing over the fence. The final design is to be approved by the Project Herpetologist. The base of the fence is buried (to stop frogs from digging under the fence). If there are gates in the fence, the base section of the gate must still maintain a seal with the ground by being weighed down with length of flexible chain. This fence is to be inspected weekly. Any breaches of the fence are to be raised with the Contractor for immediate repair. Vegetation should be kept clear from at least a 1 m wide buffer strip on the outer side of the fence to stop frogs climbing to a height to be able to jump over the fence. Exclusion fencing is to be removed following the completion of construction works.	site where they may be injured or killed		
Conduct a pre-clearance survey	Conduct a pre-clearance survey within the footprint immediately prior to constructions works being undertaken. The survey should include two diurnal and two nocturnal surveys, with the last nocturnal survey conducted the night prior to works being undertaken. **Winter to spring frog encounters:** If Green and Golden Bell Frogs are encountered sheltering in the base of dense vegetation or underneath rock, rubble or wood they need to be assessed for an over wintering position or torpor. Then the frogs are to be collected in accordance with the following protocol: • Placed in a clean, plastic holding container with 50 ml of purified water (at a minimum) • Frogs should be micro-chipped if not already tagged • Adult frogs should be sexed (if adult and showing external characteristics), snout-vent length measured, weight recorded, condition of the frog recorded (as determined by the Project Herpetologist), date and location of collection • The Project Herpetologist is to provide guidance when injured frogs are found	Mortality/ injury of individuals avoided	Prior to commencement of construction works	Construction Contractor Project Herpetologist (or suitably qualified ecologist under the guidance of the Project Herpetologist)

Measure	Action	Outcome	Timing	Responsibility
	• If frogs are not in torpor, the procedure for spring to autumn encounters applies. **Spring to autumn frog encounters**: If active frogs are encountered, then they are to be collected in accordance with the following protocol: • Placed in a clean, plastic holding container with a small amount of purified water • Frogs should be microchipped if not already tagged • Adult frogs should be sexed, snout-vent length measured, weight recorded, condition of the frog, date and location of collection. Frogs found in the works footprint can then be relocated to suitable sheltering habitat within the established frog exclusion zone.			
Site inductions	Site inductions should contain a relevant section on the Green and Golden Bell Frog. The induction should incorporate: • What to do in the event of unexpected finds of frogs within the construction zone (see below) • Hygiene protocols (see below) • Highlighting the exclusion zone and Management Area and why these are a 'no-go' zone.	Exclusion of humans from entering frog habitat Mortality/ injury of individuals avoided Reduction in risk of introduction of amphibian chytrid fungus	Prior to commencement and throughout construction works	Construction Contractor
Stop work or unanticipated find procedure	The following procedure is to be implemented when Green and Golden Bell Frogs are observed within the works footprint: 1. Frogs observed during course of construction 2. STOP WORK IMMEDIATELY and notify site supervisor. Try to photograph the frog to assist in confirmation of the species. DO NOT RECOMMENCE WORK until directed by the Project Herpetologist and site supervisor. 3. Environmental representative to inform: a. Project Manager	Mortality/ injury of individuals avoided	Throughout construction works	Construction Contractor Bayside Council Project Herpetologist

Measure	Action	Outcome	Timing	Responsibility
	b. Bayside Council c. Project Herpetologist 4. Suitably qualified ecologist or representative appointed by the Project Herpetologist to follow procedures for winter to spring encounters and/or spring to summer encounters (detailed above) 5. Project Herpetologist, Bayside Council AND Site Supervisor declare works 'okay' to re-commence.			
Hygiene protocol	The following have been prepared in consideration with the NSW Hygiene Guidelines (DPIE 2020a): • All personnel (including visitors) to be inducted on chytrid management measures for the site • Avoid entry to the Management Area, Landing Lights Wetland and frog exclusion zone wherever possible • Work should be scheduled during dry weather (and not immediately following wet weather) to reduce adhesion of soil/mud to footwear, clothing, equipment and vehicles • Check and clean clothing, footwear, tools, equipment, vehicles and heavy machinery for soil, plant material/propagules and other debris • Disinfect with any of the following (depending on application): o 70% methylated spirits in water o 1% sodium hypochlorite in water o Benzalkonium chloride (various concentrations) o Industrial strength detergent o Chloramine and chlorhexidine-based products o Alcohol wipes o Alcohol gel As with all chemicals, disinfectants must be administered away from waterways • Keep hygiene kits at strategic locations (e.g., site office and each vehicle) containing the following (at a minimum): o Stiff brush o Spray bottle	Reduction of risk of introduction of amphibian chytrid fungus	Throughout construction works	Construction Contractor

Measure	Action	Outcome	Timing	Responsibility
	○ Container of disinfectant solution with enough volume for several refills of the spray bottle • Where practical, provide vehicle wash down facility and boot wash down facility • Restrict vehicles to designated tracks, trails and parking areas • Provide parking and turn-around points on hard, well-drained surfaces • Provide boot wash down facility • If handling frogs is necessary and unavoidable, the following controls should be applied: ○ Wear disposable, non-powdered gloves when handling amphibians ○ Use new gloves or a new bag for handling each individual amphibian ○ Wear well-rinsed (with water) vinyl gloves when handling tadpoles ○ If gloves are not available, wash hands with 70% alcohol between handling each animal ○ Make sure hands are dry before handling amphibians as alcohol exposure may be toxic to them. Rinse hands with potable water (if available) after disinfecting ○ Keep individual amphibians in separate containers. Dispose of or disinfect containers after use ○ Where possible, keep tadpoles in separate containers. If necessary, tadpoles from the same pond or stream section can be grouped in one container but avoid overcrowding. ○ Never mix amphibians from different sites. ○ Amphibians should be released where they were captured.			
Sediment and erosion controls	Mitigation and management measures for the Management Area are detailed in the WEMP (ELA 2021a) and include installing erosion and sediment controls around remediation works area to prevent mobilisation of contaminated soils into adjacent aquatic habitats.	Input of sediment-laden flow and/or contaminants avoided	Prior to commencement, weekly during construction works, and following rain	Construction Contractor

Measure	Action	Outcome	Timing	Responsibility
	Controls are to be inspected weekly and following heavy rain (> 30 mm within 24 hr period). Any breaches are to be raised with the Contractor for immediate repair.	Reduction of risk of introduction of Plague Minnow		
Contaminant controls	Controls for the Management Area are detailed in the WEMP (ELA 2021a) and include the following: • Store all chemicals (e.g., fuel, oil) offsite. If required to be stored onsite, store chemicals in appropriate bunding/storage systems, outside of the Management Area and only for short periods • Ensure appropriate spill kits, are present onsite • Ensure all equipment is in good working order • Carry associated Safety Data Sheets (SDS) for all chemicals • Do not use any chemicals that are labelled as 'Class 9 Environmentally hazardous' as part of the proposed activities • Do not stockpile rubbish or store chemicals near native vegetation or waterways • Limit the use of fuel, chemicals and herbicides near waterways and other sensitive areas.	Input of sediment-laden flow and/or contaminants avoided	Throughout construction	Construction Contractor
Light spill management	Directional lighting should be used to avoid light spill into the Management Area after daylight hours.	Reduction of light spill	Throughout construction	Construction Contractor

5.2. Ongoing Mitigation and Management Measures

Management measures relating to the ongoing operation and maintenance associated with the Barton Park Precinct Masterplan and Grandstand are outlined in Table 4. These measures should be considered as a minimum requirement and implementation is the responsibility of the Construction Contractor and Bayside Council (in consultation with the Project Herpetologist). All works undertaken within the Management Area must follow the Hygiene Protocol in Table 3.

Table 4: Ongoing mitigation and management measures

Measure	Action	Outcome	Timing	Responsibility
Enhance habitat within Management Area	Habitat enhancement should consist of the following: • Improved areas of foraging habitat consisting of tussocky grasslands • Ensure connectivity throughout corridors or 'habitat islands' made up of structured vegetation, boulders and/or logs, suitable for sheltering • Consider the manipulation of water levels to limit numbers of predatory fish and increase habitat variation for frogs. Establishment and enhancement of frog habitat is to be conducted in consultation with: • Best Practice Green and Golden Bell Frog Habitat Guide (DECC 2008b) • Protecting and restoring Green and Golden Bell Frog habitat (DECC 2008c) • Person with at least five years' experience in the design of Green and Golden Bell Frog habitat or by a frog expert.	Habitat connectivity and function maintained Reduction of risk of establishment of Plague Minnow	During construction Throughout the life of the project	Bayside Council Construction Contractor
Informative signage	Installation and maintenance of signage detailing the values of the Landing Lights Wetlands to local biodiversity, particularly Green and Golden Bell Frogs and the importance of ensuring shoes and clothes are clean.	Raised awareness of potential Green and Golden Bell Frog presence in Precinct users	Throughout the life of the project	Bayside Council Construction Contractor
Control threats within Management Area	Develop measures to reduce threats of Chytrid, Plague Minnow, noxious weeds and predation by feral cats, foxes or pets visiting the Precinct.	Mortality/ injury of individuals avoided	Throughout the life of the project	Bayside Council

Measure	Action	Outcome	Timing	Responsibility
	Consider periodic flooding and draining of the Landing Lights Wetland to limit numbers of Plague Minnow. Presence of Plague Minnow should be monitored and if present, measures to kill these fish should be undertaken.	Reduction of risk of introduction of amphibian chytrid fungus Reduction of risk of establishment of Plague Minnow		
Light spill management	Directional lighting should be used to avoid light spill into the Management Area after daylight hours. Lights are to be switched off or dimmed outside of operational hours to reduce potential impacts to frogs.	Reduction of light spill	Throughout the life of the project	Project Manager Construction Contractor

6. Monitoring and Reporting

6.1. Reporting during construction

A report detailing the implementation of the actions set out in Table 3 of this plan will be prepared by the contractor on a quarterly basis during construction. This report must be provided to DPIE.

6.2. Monitoring

Regular monitoring of Green and Golden Bell Frogs is undertaken within Barton Park Landing Lights West and Barton Park Landing Lights East (as shown in Figure 4) on behalf of Transport for NSW, as part of the management of the Green and Golden Bell Frog Arncliffe population. Monitoring undertaken as part of this GGBF MP is not intended to replace existing monitoring programs, but rather should support them by extending their extent within the Management Area (Figure 1).

The following is an outline of the adaptive monitoring program that will be undertaken to assess the effectiveness of the construction and operational mitigation measures for the Arncliffe population of the Green and Golden Bell Frog.

6.2.1. Baseline surveys

Monitoring requirements outlined in Section 6.2.2 and 6.2.3 require baseline data for the purposes of comparison. A baseline survey to collect data on the following is required to be undertaken within the Management Area prior to the commencement of construction works:

- Frog surveys (existing data may be used to replace survey)
- Available food supply
- Presence of potential predators
- Presence of chytrid
- Artificial light spill (existing data may be used to replace survey).

An additional survey of the above should be undertaken immediately following construction works.

6.2.2. Monitoring effectiveness of management and mitigation measures during construction

The measures outlined in Table 3 will be monitored to determine their effectiveness in managing the potential for indirect impacts to Green and Golden Bell Frog habitat during construction. Table 5 outlines the elements of the monitoring program.

Table 5: Monitoring requirements to assess effectiveness of measures during construction

Measure to be assessed	Element monitored	Where monitored	Frequency of monitoring	Responsibility	Threshold Trigger	Action Response
Delineation of the works footprint	Area cleared	Entire extent of Management Area, particularly at in the vicinity of the works footprint	Following clearance	Construction Contractor	Clearance of additional areas Distance between the edge of the Landing Lights Wetland and the edge of the area cleared is < 20 m	Assessment of potential impacts to Green and Golden Bell Frog Additional measures may be required following impact assessment
Frog exclusion zone	Fence integrity	Entire extent of frog exclusion zone	Weekly	Construction Contractor	Damage or breaches	Fix fence within 24 hours of detection of damage Stop works until completion of additional pre-clearance survey
Frog exclusion zone	Number of unexpected frog encounters	Within works footprint	As encountered	Construction Contractor	Unexpected frog encounter	Consider increasing the extent of the frog exclusion zone Consider undertaking more regular pre-clearance surveys
Sediment and erosion control	Integrity of sediment and erosion fencing/control measures	Wherever control fences/measures are located	Weekly and following heavy rain events (> 30 mm within 24 hr period)	Construction Contractor	Damage or breaches	Fix fence/controls within 24 hours of detection of damage
Light spill control onto Landing Lights Wetland	Light reaching frog habitat from works footprint	Landing Lights Wetland	At first lighting Following installation of new luminary system	Bayside Council Project Herpetologist	Light reaching frog habitat	Project Herpetologist to advise on lighting effects at night

6.2.3. Monitoring effectiveness of ongoing mitigation and management measures

The measures outlined in Table 4 will be monitored to determine their effectiveness in managing the potential for indirect impacts to Green and Golden Bell Frog habitat during operation of the Barton Park Precinct and Grandstand. Table 6 outlines the monitoring program. Changes in the vegetation and performance of wetland works would be monitored as part of the WEMP (ELA 2021a).

Table 6: Monitoring requirements to assess effectiveness of ongoing mitigation and management measures

What monitored	How monitored	Where	Who monitors	Threshold Trigger	Action Response
Green and Golden Bell Frog population	Annually, in accordance with the NSW Survey Guide for Threatened Frogs (DPIE 2020b)	Management Area (in consultation with contractors undertaking regular monitoring for the Arncliffe population)	Suitably qualified ecologists, as set out by Section 2.2. of the NSW Survey Guide for Threatened Frogs (DPIE 2020b)	If in the opinion of the Project Herpetologist, the population is declining	Assess whether food supply is sufficient within Management Area; if not, consider introducing food supply. Assess whether predation is occurring. Assess whether decline is due to chytrid via standard chytrid assessment methods. Consider further habitat enhancement measures. Consider blocking public access to parts of the frog habitat.
Successful breeding	Annual surveys for tadpoles, calling males and/or gravid females in accordance with the NSW Survey Guide for Threatened Frogs (DPIE 2020b)	Management Area	Suitably qualified ecologists	No tadpoles present	Assess whether predation by Plague Minnow is occurring. Test water quality, assess presence of other predators/competition by conspecifics (e.g., Striped Marsh Frogs). Consider blocking public access to parts of the frog habitat.

What monitored	How monitored	Where	Who monitors	Threshold Trigger	Action Response
Presence of predators	Annual surveys for Plague Minnow and signs of non-aquatic predators (e.g., feral cats, foxes, dogs)	Management Area	Bayside Council	Predators detected	Consider flooding and draining of the Landing Lights Wetland to limit numbers of Plague Minnow. Remove predators via appropriate method that limits harm to bell frogs. If predators other than foxes, cats or dogs are detected, other control measures would need to be considered. Consider blocking public access to parts of the frog habitat.

6.2.4. Annual reporting of monitoring

Results of the monitoring, review and any amendments must be reported annually to DPIE. This should be done after the monitoring results have informed the next iteration of the plan; and the plan has been reviewed and amended. The monitoring results should be published on the project website.

6.3. Review of Management Plan

This plan must be reviewed annually following monitoring. The annual review must be carried out in consultation with relevant agencies (i.e., DPIE, Bayside Council, other parties implementing Green and Golden Bell Frog Management Plans for the Arncliffe Key Population).

Information included in the review will include monitoring results, details of any corrective actions and details of any action or activity carried out to increase the security of the population at Arncliffe.

The plan must be amended if the review indicates that elements of the plan require updating. These should reflect the effectiveness of mitigation and the ongoing survival of the population at Arncliffe.

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