



Cannes Reserve Flying-fox Camp Management Plan

2015 - 2020

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Acronyms and abbreviations

ABLV	Australian bat lyssavirus
BFF	Black flying-fox (<i>Pteropus alecto</i>)
CMP	Camp Management Plan
DoE	Commonwealth Department of the Environment
EEC	Endangered Ecological Communities
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
GHFF	Grey-headed flying-fox (<i>Pteropus poliocephalus</i>)
LEP	Local Environmental Plan 2014
LGA	Local Government Area
LRFF	Little red flying-fox (<i>Pteropus scapulatus</i>)
MNES	Matter of national environmental significance
NPW Act	NSW <i>National Parks and Wildlife Act 1974</i>
OEH	Office of Environment and Heritage
PoM	Cannes Reserve and Gonyah Place Reserve Plan of Management including the Cannes Reserve Flying-fox Colony Management Plan
SIS	Species Impact Statement
SEPP 14	State Environmental Planning Policy No 14—Coastal Wetlands
SEPP 26	State Environmental Planning Policy No 26—Littoral Rainforests
The Reserve	Cannes Reserve
The Reserves	Cannes Reserve and Gonyah Place Reserve
TSC Act	NSW <i>Threatened Species Conservation Act 1995</i>

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1 Overview

A grey-headed flying-fox (*Pteropus poliocephalus*; GHFF) camp within Cannes Reserve, Avalon in the Pittwater Council Local Government Area (LGA) has been creating conflict with nearby residents, and Council is seeking to progress further management to mitigate these community impacts.

The GHFF is listed as vulnerable under the New South Wales *Threatened Species Conservation Act 1995* (TSC Act) and Commonwealth *Environment Protection and Biodiversity Act 1999* (EPBC Act).

This document supplements the current Cannes Reserve Flying-fox Colony Management Plan within the Cannes Reserve and Gunyah Place Reserve Plan of Management (PoM) (Pittwater Council 2011). It is consistent with the NSW Office of Environment and Heritage (OEH) Camp Management Plan (CMP) under the new Flying-fox Camp Management Policy Consultation Draft (2014). Commonwealth permitting requirements are written in accordance with the Draft EPBC Act Policy Statement: camp management guidelines for the GHFF and spectacled flying-fox (DoE 2014).

1.1 Objectives

The objectives of the PoM and this CMP are to:

- balance the amenity of residents within the LGA with habitat for the GHFF
- comply with legislative requirements, animal welfare and conservation objectives
- manage public health and safety risks
- protect the Endangered Ecological Communities (EECs) within the reserve by minimising vegetation modification
- provide community education and awareness of GHFF and biodiversity issues in relation to Cannes Reserve
- minimise community impacts by progressing additional management activities.

1.2 Purpose and intention

The purpose of this document is to provide a CMP in accordance with the OEH draft flying-fox camp management policy (OEH 2014). If approved by OEH (in combination with other relevant licence applications and legislative requirements) this CMP will enable additional vegetation management and camp dispersal under NSW state legislation.

2 Context

2.1 Camp area

The flying-fox camp is located in Cannes Reserve (Lot 18 DP 236595 and Lot 2 DP 209496) between Cannes Drive and Therry Street, Avalon (the Reserve), within the Pittwater Council LGA (Figure 1). Roosting flying-foxes occasionally spill over to the adjoining Gunyah Place Reserve (Lot 4 DP 232257), which is undesirable due to a playground at this location.

The camp is in remnant vegetation, dominated by Coastal Littoral Rainforest and bordered by Pittwater Spotted Gum Forest, both of which are EECs under the TSC Act. The extent of these communities in the Reserve is shown in Section 5.

Cannes Reserve is 0.67 hectares in total, including 0.14 hectares of unformed road (Net Road). The adjoining Gunyah Place Reserve is 0.08 hectares, however much of this area is cleared parkland with little suitable roost habitat. Since 2012, the camp extent ranges between approximately 0.22 hectares and 0.25 hectares (as occupied during the 2014 influx).



Figure 1: Location and extent of Cannes Reserve GHFF camp

Pittwater Council
 Cannes Reserve flying-fox camp management plan

- Waterway
- Cannes Reserve
- Gunyah Place Reserve parkland
- Cadastral boundaries
- Flying-fox roost extent, 2014
- Flying-fox roost extent, 2012



Job number: GW146
 Revision: 0
 Author: MED
 Date: 18/12/2014



GDA 1994 MGA Zone 56
 Projection: Transverse Mercator
 Datum: GDA 1994
 Units: Meter

2.2 History of the camp

Flying-foxes were first recorded using this Reserve as a camp approximately 10 years ago. The number of animals within the core of the Reserve has increased from approximately 200 to an estimated 500 over time (Ecosure pers. obs. 2014). Two unusual influxes have occurred for one month during winter of 2013 and 2014 (Section 4.2).

For further detail see Section 4.2.

2.3 Identification of flying-fox issues

Residents living near the camp have reported a broad range of associated health and wellbeing, economic and amenity impacts (see Section 3).

The number of residents reporting impacts has also increased over time from three in 2009 to 26 in 2014. The breadth of reported impacts has also increased over time. The increase in impacts and number of complaints appears correlated with increasing flying-fox numbers, with few impacts recorded when the camp was small (approximately 200 individuals or fewer).

As identified by Council during community consultation, there is also a number of residents who enjoy the flying-foxes, although their residences are set back from the camp itself.

2.4 Classification of the land

The Cannes Reserve and Gunyah Place Reserve are owned and managed by Pittwater Council.

The Reserves were created as part of a suburban subdivision in 1967/1968 (PoM). The area surrounding the Reserves is zoned 2(a) Residential (“A”) consisting of low density housing within a forest setting. Fourteen residences adjoin the Reserves (Pittwater Council 2010).

2.5 Management response to date

Pittwater Council has invested significantly into managing community impacts associated with the Cannes flying-fox camp. These include:

- appointing a resident working group to address resident concerns and assist in the development of the management plan
- developing the PoM (Pittwater Council 2011) to provide a framework for the management of the camp
- facilitating regular community meetings and other community liaison
- seeking external advice from flying-fox experts and researchers
- providing information to residents on measures to reduce impacts, and promoting understanding of biodiversity issues of the site

- maintaining a web page for community engagement on the issue
- progressing on-ground works to create a buffer between residents and flying-foxes, including:
 - multiple licence applications to OEH
 - developing the required Species Impact Statement (ELA 2012)
 - removing camp vegetation (including on private property)
 - weed removal and restoration of the Reserves
- applying for grant funding to enable affected residents to install air conditioning and double-glazed windows at no personal cost
- planting Bolwarra as a visual and odour buffer between the camp and impacted residences
- developing this CMP.

These measures have offered some relief for some residents, however have not sufficiently mitigated impacts to date.

2.6 Stakeholders

Key stakeholders in the Reserves and flying-fox camp and their roles/impacts include:

- Pittwater Council: required to resolve conflicts and resource management strategies.
- OEH: responsible for administering legislation relating to the conservation and management of native flora and fauna.
- Surrounding residents: some are aggrieved by the smell, noise and disturbance caused by the camp.
- Commonwealth Department of the Environment (DoE): responsible for legislation relating to federally listed threatened species such as the GHFF.
- Representatives from wildlife organisations: concerned for the welfare of the flying-foxes and their habitat.

Pittwater Council regularly liaises with these stakeholders, and will continue to do so during implementation of this CMP.

2.7 Other legislation, policies and agreements

The below details policy and legislation relevant to management actions described within and the specific requirements under each.

2.7.1 Local

2.7.1.1 Pittwater Natural Areas Plan of Management and the Cannes Reserve and Gunyah Place Reserve Draft Plan of Management

The PoM forms a reserve chapter in the Pittwater Natural Areas Plan of Management, and provides management strategies to effectively manage and conserve the Reserves.

2.7.2 Pittwater Local Environmental Plan 2014

The Pittwater Local Environmental Plan (LEP) 2014 is the guiding document for development and land use.

Section 5.9 'Preservation of trees or vegetation' includes '(3) *A person must not ringbark, cut down, top, lop, remove, injure or wilfully destroy any tree or other vegetation to which any such development control plan applies without the authority conferred by:*

- (a) development consent, or*
- (b) a permit granted by the Council.'*

Section 5.9AA of the LEP 'Trees or vegetation not prescribed by development control plan' includes:

- (1) This clause applies to any tree or other vegetation that is not of a species or kind prescribed for the purposes of clause 5.9 by a development control plan made by the Council.*
- (2) The ringbarking, cutting down, topping, lopping, removal, injuring or destruction of any tree or other vegetation to which this clause applies is permitted without development consent.*

Clause 7.6 'Biodiversity' aims to maintain biodiversity by protecting such aspects as native flora and fauna and ecological processes. This clause is applicable to land mapped as "Biodiversity" on the Biodiversity Map.

Note Council is exempt from requirements under the LEP provided works are on Council land.

Local environmental plans such as this may be used to zone camps for protection, to ensure long-term security. They should also be used to appropriately zone land adjacent to camps.

2.7.3 New South Wales

2.7.3.1 National Parks and Wildlife Act 1974

The National Parks and Wildlife Act 1974 provides for the conservation of nature, the conservation of objects, places or features of cultural value and the management of land reserved under this Act. All native animals and many species of native plants protected under the NPW Act. Flying-foxes are specifically protected under s.98.

Under this Act, licences can be issued for actions such as to harm or obtain any protected fauna for any specified purpose, pick protected native plants specified therein (where pick includes to *gather, pluck, cut, pull up, destroy, poison, take, dig up, crush, trample, remove or injure the plant or any part of the plant*), or to damage habitat of a threatened species, an endangered population or an EEC.

Please note that a separate licence may be required under the *Threatened Species Conservation Act 1995* relating to threatened species, populations and communities.

2.7.3.2 Threatened Species Conservation Act 1995

The GHFF is listed as vulnerable under the TSC Act. Two listed EECs (Littoral Rainforest and Pittwater Spotted Gum Forest) also occur within the site, and a number of other threatened species have been recorded using the site i.e. powerful owl (*Ninox strenua*). Further detail of threatened species can be found in the SIS (ELA 2012).

The objects of the *Threatened Species Conservation Act 1995* (TSC Act) includes to conserve biological diversity and to protect the critical habitat of those threatened species (i.e. GHFF), populations and ecological communities (i.e. EECs on site). The literature review indicated that threatened flora and fauna species and endangered populations listed under the TSC Act have been recorded within the search area (10 x 10km).

Section 91 of the TSC Act provides for the application of licences if the proposed action is likely to:

- (a) *harm to any animal that is of, or is part of, a threatened species, population or ecological community,*
- (b) *the picking of any plant that is of, or is part of, a threatened species, population or ecological community,*
- (c) *damage to critical habitat,*
- (d) *damage to habitat of a threatened species, population or ecological community.*

Section 94 of the Act, provides factors (the 7 part test) to assess whether the proposed action is likely to have a significant effect on threatened species, populations or ecological communities, or their habitats. When assessing a licence application, if the NSW OEH determines that a significant effect is likely, it may require a SIS to be prepared. If OEH assesses a s. 91 licence application and determines that a significant impact is unlikely, a s. 95 certificate will be issued (Appendix 1 provides a flow chart for this process).

A SIS was prepared as part of the process to implement buffers in the Reserve, and describes potential impacts associated with this management action on the above values.

2.7.3.3 Flying-fox Camp Management Policy 2014: Consultation Draft

OEH has introduced a revised Draft Flying-fox Camp Management Policy in 2014 to replace the 2007 Policy.

The objectives of the 2014 Flying-fox Camp Management Policy are to:

- address the potential impacts of flying fox camps on human health
- minimise the impact of camps on local communities
- provide a balance between conservation of flying-foxes and their impacts on human settlements
- clarify roles and responsibilities for OEH, local councils and other land managers such as managers of Crown Lands
- provide options for land managers to obtain upfront five year licensing to improve flexibility in the management of flying-foxes
- enable land managers and other stakeholders to use a range of suitable management responses to sustainably manage flying-foxes
- require land managers to consider the behaviours, habitat and food requirements of flying-foxes when developing and implementing camp management plans
- enable long term conservation of flying-foxes in appropriate locations by encouraging land managers to establish and protect sufficient food supplies and roosting habitat.

2.7.3.4 Prevention of Cruelty to Animals Act 1979

It may be an offence under this Act if there is evidence of unreasonable/unnecessary torment associated with management activities (i.e. dispersal). Adhering to welfare and conservation measures provided throughout Section 7 will ensure compliance with this Act.

2.7.3.5 Environmental Planning and Assessment Act 1979

Development control plans under s. 72 of the Act should consider flying-fox camps so that planning, design and construction is appropriate to avoid future conflict.

2.7.4 Commonwealth

2.7.4.1 Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth's EPBC Act provides protection for the environment, specifically matters of national significance. A referral to the federal DoE is required under the EPBC Act for any action that is likely to significantly impact on a matter of national environmental significance (MNES).

MNES under the EPBC Act are:

- world heritage sites
- national heritage places
- wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed)
- nationally threatened species and ecological communities
- migratory species
- Commonwealth marine areas
- nuclear actions.

The GHFF is listed as nationally vulnerable under the EPBC Act. There are also a number of other MNES and communities that occur within the area (Table 1). Surveys are required to determine their likely use of the Reserve.

As per the self-assessable criteria in the Significant Impact Guidelines 1.1 (DoE 2013) 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
- reduce the area of occupancy of an important population.
- fragment an existing important population into two or more populations
- adversely affect habitat critical to the survival of a species
- disrupt the breeding cycle 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
- result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat
- introduce disease that may cause the species to decline, or
- interfere substantially with the recovery of the species.

Previously critical GHFF habitat (where management may require referral to the DoE) was based on criteria in the GHFF draft national recovery plan (DECC 2009). However, recently guidelines for camp management have been released as a draft EPBC Act Policy Statement (DoE 2014). These guidelines define a nationally important GHFF camp as one that has either:

- i. contained $\geq 10,000$ GHFF in more than one year in the last 10 years, or
- ii. been occupied by more than 2,500 GHFF permanently or seasonally every year for the last 10 years.

As confirmed by DoE:

- these guidelines are now in force and will remain the guide as to whether referral is required for management at a GHFF roost until the policy is finalised or otherwise superseded
- a referral is not required for management at any roost (including those that meet nationally important criteria) under the draft policy, provided that best practice mitigation standards detailed in the policy (or in state standards with the same intent) are followed.

2.7.5 Relevant international agreements

The GHFF is listed as Vulnerable on International Union for Conservation of Nature and Resources (IUCN) Red List because of continuing population decline, estimated at more than 30% over the last three generations (IUCN 2012).

2.7.6 Current licences and approvals

A summary of previous and current licences for management at the Cannes Reserve are provided in 0.

2.7.7 Site-specific ecological values

A literature review identified those ecological values outlined in Table 1 for the camp area and immediate surrounds. Requirements for each are also summarised.

Table 1 Results from the desktop assessment of the study site.

Source	Results	Permits/approvals required to remove vegetation
Commonwealth		
EPBC Protected Matters Report (5km search; DSEWPC 2010)	Under the <i>EPBC Act</i> , within a 5 km radius, there are 3 listed threatened ecological communities, 15 listed flora species, 51 listed fauna species and 49 listed migratory species which are known or likely to occur with the area. One national heritage property (i.e. Ku-ring-gai Chase National Park, Lion, Long and Spectacle Island Nature Reserves) also occurs within the search area. The camp meets does not meet criteria for a nationally important GHFF camp in the draft Camp Management Guidelines (DoE 2014). Therefore provided management is in accordance with state requirements, a referral for management of this GHFF camp (including dispersal) is unlikely required.	Under the <i>EPBC Act</i> , any action which is likely to have a significant impact on a matter of national environmental significance will require approval from the Minister for the Environment.
State		
Atlas of NSW Wildlife (10 km x 10km search)	Under the <i>Threatened Species Conservation Act 1995</i> , 8 threatened flora species, 34 threatened fauna species and 2 endangered populations have been recorded within a 10 km x 10km search area around the site.	A licence may be required under section 91 of the <i>Threatened Species Conservation Act 1995</i> . A Species Impact Statement may be required if a significant impact is likely.
State Environmental Planning Policy No 44—Koala Habitat Protection	Field surveys need to determine if the site is potential koala habitat. If so, it must be determined if the site is core koala habitat.	If the site is assessed as being core koala habitat, a plan of management must be prepared in accordance with Part 3 of the SEPP 44.
State Environmental Planning Policy No 14—Coastal Wetlands	SEPP 14 coastal wetlands are not mapped as occurring within the site or within the close vicinity of the site.	No permits required
State Environmental Planning Policy No 26—Littoral Rainforests	SEPP 26 littoral wetlands are not mapped as occurring within the site or within the close vicinity of the site.	No permits required
Local		
Pittwater Local Environmental Plan 2014	The site is mapped as "Biodiversity" on the LEP biodiversity map. Any removal of endemic vegetation (excluding trimming) will impact on the biodiversity values of the site.	Council exempt – no approvals required.

Source	Results	Permits/approvals required to remove vegetation
Cannes Reserve and Gonyah Place Reserve Draft Plan of Management	Under the <i>Threatened Species Conservation Act 1995</i> , two endangered ecological communities occur within the site, being Littoral Rainforest and Pittwater Spotted Gum Forest.	A licence may be required under section 91 of the <i>Threatened Species Conservation Act 1995</i> .

3 Community considerations

Residents living near the camp have reported the following impacts (Pittwater Council 2011; EcoLogical 2012):

- disruptive and continual noise produced by the GHFFs, leading to sleep deprivation
- odour (particularly after rainfall)
- dead animals (fear of disease)
- excrement (mess, damage to property and repair costs)
- fear of disease
- potential property devaluation
- loss of residential amenity.

Council commissioned a noise monitoring study which showed consistent noise during the day, and elevated noise as GHFFs return from foraging in the early morning (from ~4am), and prior to evening departure. These noise levels were described as highly intrusive in terms of the level and character (Atkins Acoustics 2013).

These issues have reportedly led to:

- medically diagnosed stress and ill health associated with lack of sleep
- difficulties in acquiring rental tenants
- lower rental charges
- costs associated with repairing or cleaning
- damaged property
- impact on the ability of students to cope with the pressures of completing required assessment.

It is important to acknowledge that there are residents around the Reserve who enjoy the flying-fox camp, and are unlikely to be in favour of certain management actions such as dispersal.

4 Ecological considerations

Three species of flying-foxes are known to occur within the Pittwater Council LGA:

- black flying-fox (*P. alecto*) (BFF)
- GHFF (*P. poliocephalus*)
- little red flying-fox (*P. scapulatus*) (LRFF).

Historical records from the Cannes Reserve camp are exclusively GHFF.

4.1 GHFF ecology

4.1.1 Distribution and habitat requirements

The GHFF is found throughout eastern Australia, from Rockhampton in Central Queensland to Melbourne, Victoria, generally within 200 kilometres of the coast (EHP 2011). This species occasionally ranges into South Australia and has been observed in Tasmania (SEWPAC 2012).

The GHFF forages and roosts in rainforest, open forests, closed and open woodlands and is also found throughout urban and agricultural areas where food trees exist (DEC 2005; EHP 2011).

4.1.2 Foraging, roosting and movement patterns

All flying-foxes are nocturnal, resting during the day in communal camps or roosts. These camps may range in size from a few individuals to hundreds of thousands, fluctuating in response to local food availability. Camps are generally located in gullies, close to a water source, in vegetation with a dense canopy or closed understorey and within 20 kilometres of a regular food source. Flying-foxes forage on fruits of rainforest trees and vines, as well as nectar and pollen of native trees (especially Eucalyptus, Melaleuca and Banksia species). They also feed on fruit crops and gardens, at times causing severe crop damage (DEC 2005). GHFF may travel up to 100km in a single night with a foraging radius of up to 50km from their camp (McConkey et al, 2012).

The GHFF population has a generally annual southerly movement in spring and summer, with their return to the coastal forests of north-east NSW and south-east Queensland in winter (Ratcliffe, 1932; Eby, 1991; Parry- Jones & Augee, 1992). This results in large fluctuations in the number of GHFF in NSW, ranging from as few as 20% of the total population in winter up to around 75% of the total population in summer (Eby, 2000a).

Flying-foxes appear to be more frequently roosting and foraging in urban areas likely due to habitat clearing, human encroachment and drought, combined with the opportunities presented by year-round food availability from native and exotic species found in expanding urban areas (Tait et al, 2014). Despite evidence of population decline in some species, these

human-influenced dynamics have led to increased interactions between humans and flying-foxes, which can lead to conflict. It should be stressed that a long term solution to any amenity issues or human exposure to disease carried by flying-foxes resides in gaining a better understanding of flying-fox ecology and applying that understanding to well-thought-out urban planning and development.

4.1.3 Reproduction

Figure 22 summarises the indicative GHFF breeding cycle. Note that these timeframes may vary considerably in response to climatic conditions and other variables. As such it is important that any management activity is prefaced by a suitably qualified person assessing the camp, and management timing adapted as required.

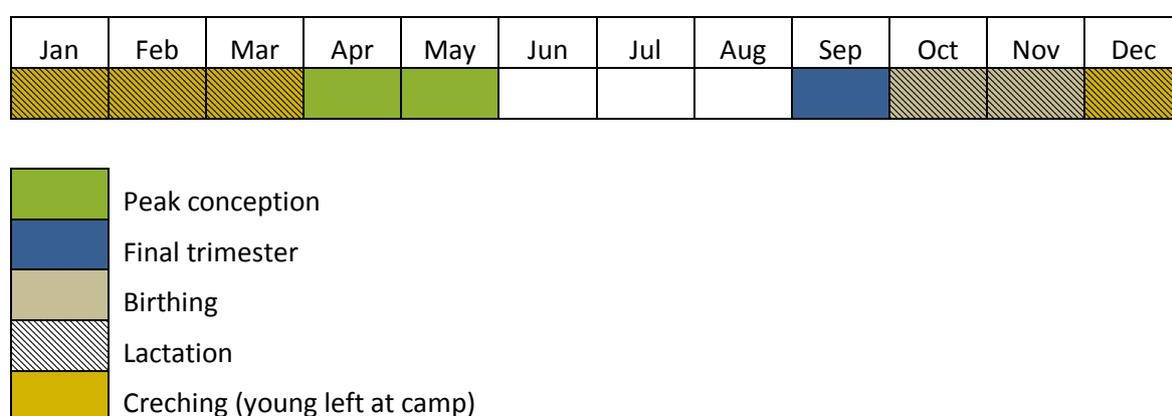


Figure 2 Indicative GHFF breeding cycle

4.1.4 Ecological role

Flying-foxes play a critical ecological role in the long term persistence of Australian tropical and sub-tropical forests through long-distance seed and pollen dispersal (Roberts et al 2006; McConkey et al 2011; Wescott et al 2008). Flying-foxes are highly mobile, capable of travelling over 100 kilometres in a single night to forage on the nectar pollen and fruit of more than 100 native trees. In this regard, flying-foxes are considered a ‘keystone species’ as they are one of the few animal groups that can disperse seed and cross pollinate plants over more than a few kilometres. This is of particular importance in the context of a continually fragmenting landscape.

4.2 Cannes Reserve Camp

The Cannes camp was initially only a small number (200) of males (Pittwater Council 2011), but has gradually grown and for the past five years has been used as a maternity camp.

Since regular monitoring began in 2011 as a condition of the Sydney Royal Botanic Gardens camp dispersal, the Cannes camp has been continuously occupied (Figure 3).

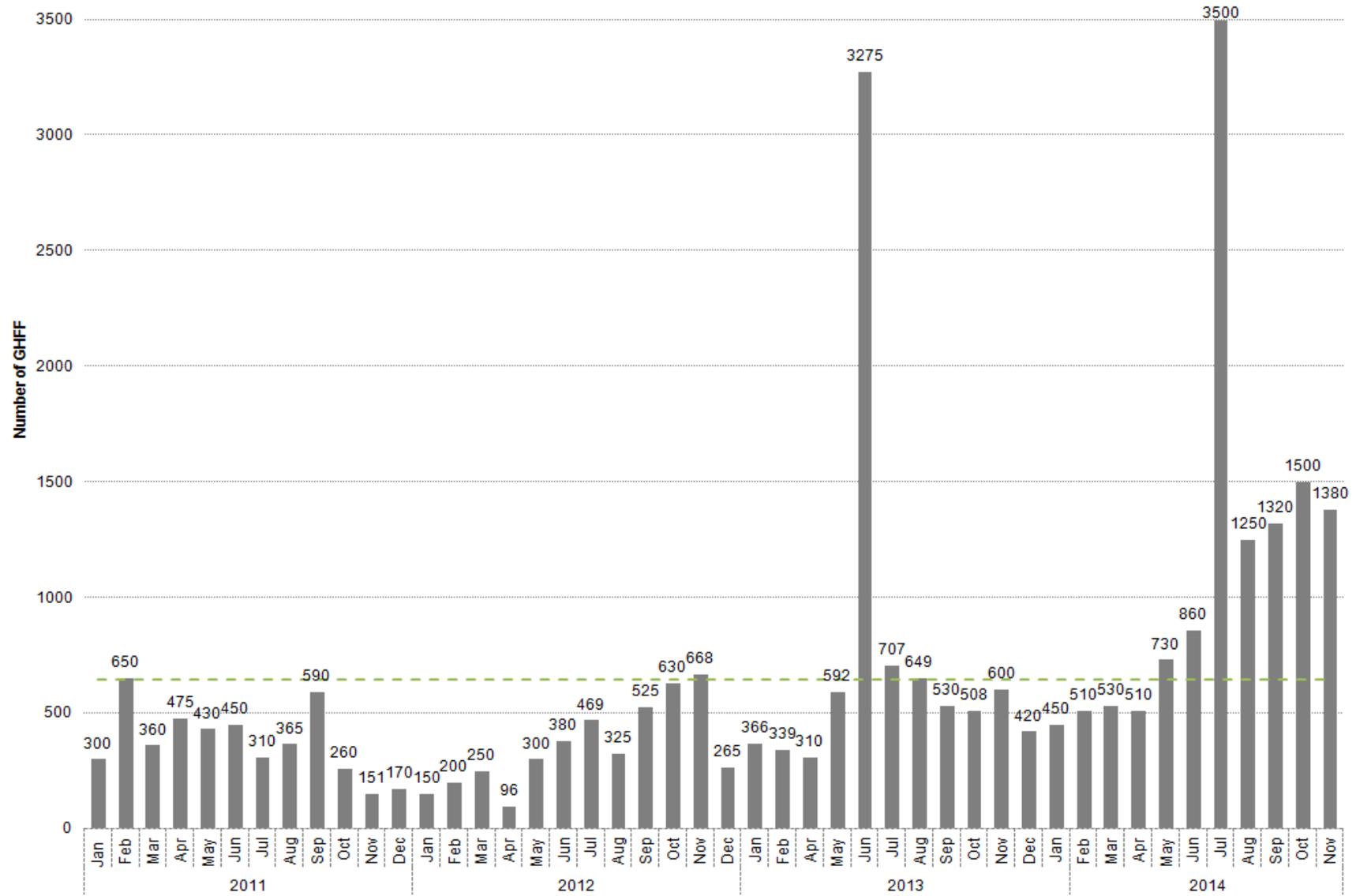
The camp has fluctuated in size over time, beginning with 200 pre-2011 and as at November

2014 was at 1380. The number within the core of the Reserve has ranged over time from 200 to approximately 500 currently. There have been two unusually large influxes in winter 2013 and winter 2014 which resulted in a peak of more than 3,000 (Figure 3). This was likely associated with an uncommon flowering event in the area, and may have been spill over from another camp in the area.

As a continuously occupied camp, the Cannes Reserve is obviously conveniently located to year round foraging resources, provides ideal roost habitat during all seasons and fulfils the particular requirements for birthing and rearing.

Other ecological values (i.e. condition and significance of the EECs on site) can be found in the accompanying SIS (ELA 2012).

Figure 3 Cannes Reserve camp historical data



4.3 Alternative camps

There is one other known flying-fox camp within the Pittwater Council LGA, which occurs in the Warriewood Wetlands (Figure 4). It was first recorded in 2008, and has since been a seasonal camp for GHFF and BFF.

Warriewood Wetlands is an ideal location for flying-foxes given suitable zoning and protection, significant buffers to potential conflict areas (i.e. residential, etc.), large size allowing for camp expansion, and educational opportunities provided by frequent recreational use of maintained walking tracks.

At less than nine kilometres to the south west, it is also relatively close to the Cannes camp. This is well within the possible nightly GHFF foraging radius of up to 50 kilometres, and the preferred foraging radius of 20 kilometres, which suggests that a large proportion of foraging habitat used by individuals from the Cannes camp could also be accessed on a nightly basis from Warriewood. The Warriewood camp is comprised of Casuarina regrowth surrounded by a mix of Melaleuca forest and wetlands. While this has potential to be ideal camp habitat for the GHFF, it currently lacks an under and midstorey which creates the complex vegetation structure, microclimate and protection favoured for permanent camps. The camp is also currently quite exposed to the prevailing winds at the site. Pittwater Council is investigating measures that can make this location more favourable as a year round permanent camp (i.e. wind rows, etc.).

The closest permanent GHFF camp is located in Ku-ring-gai Flying-fox Reserve, Gordon in the neighbouring Ku-ring-gai LGA, 21 kilometres from the Cannes camp (Figure 4). In 1991 the Ku-ring-gai Council and NSW government entered into a Conservation Agreement committing to the ongoing protection of this site, in particular the GHFF camp.

As shown on Figure 4, there are a further four known GHFF camps within the local area.

Anecdotal reports (Pittwater Council, pers. comm. 2014) are that flying-foxes historically camped within the Pittwater Council LGA at Deep Creek Reserve, 10 kilometres south-west of the Cannes Reserve (Figure 4). This is an ideal location for a camp, with good buffers to residential and commercial areas and a low potential for conflict. As such, Council is investigating an attempt to encourage this camp to re-establish, including building a crèche cage for rehabilitating flying-foxes to self-release at this location.

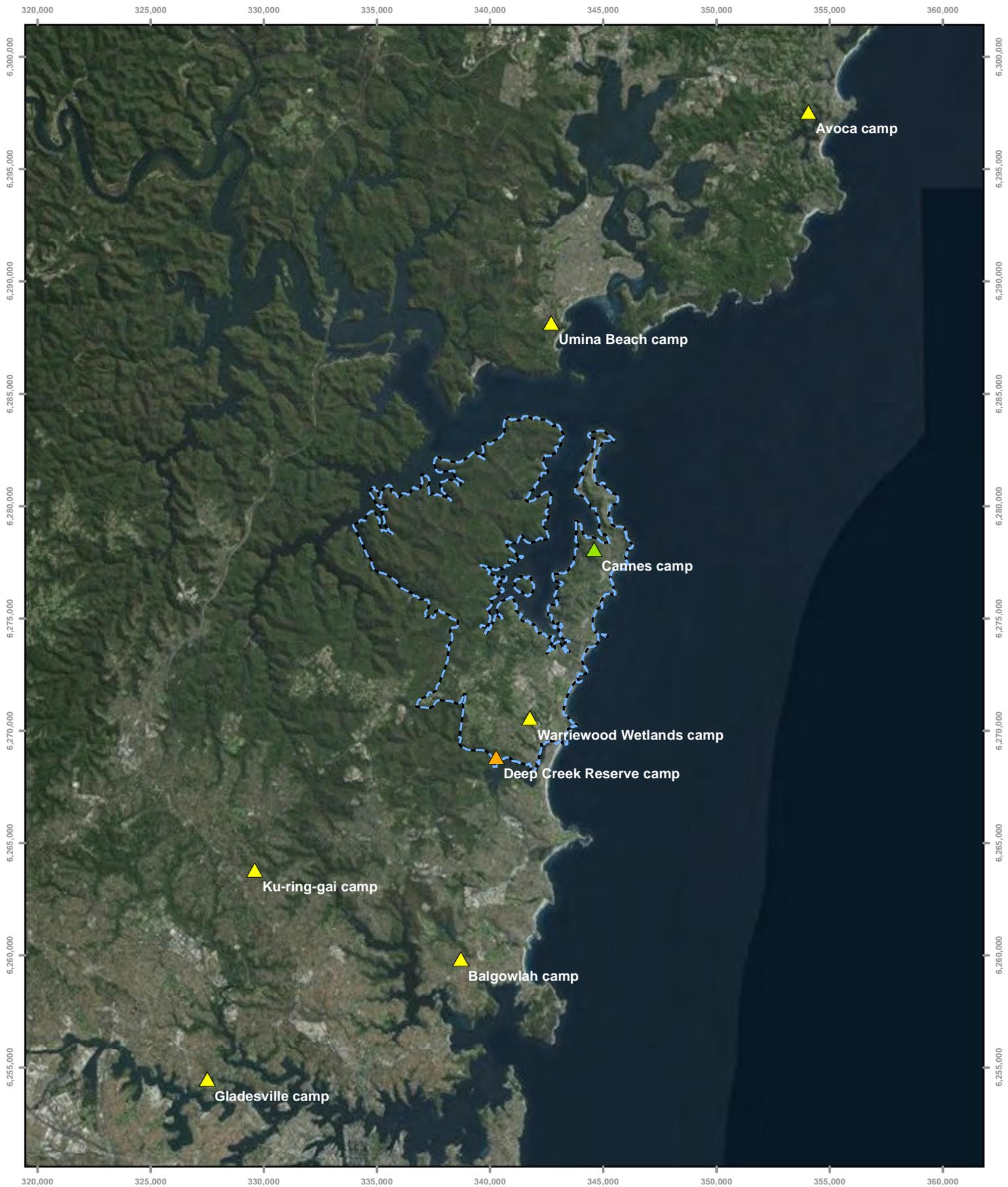


Figure 4: Known GHFF camps surrounding Cannes Reserve camp

Pittwater Council
 Cannes Reserve flying-fox camp management plan

- ▲ Cannes Reserve GHFF camp
- ▲ other GHFF camp
- ▲ historic GHFF camp (anecdotal)
- Pittwater Council boundary



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 Author: MED
 Date: 18/12/2014



GDA 1994 MGA Zone 56
 Projection: Transverse Mercator
 Datum: GDA 1994
 Units: Meter

4.3.1 Potential roost habitat mapping

A preliminary analysis was carried out to identify potentially suitable roosting flying-fox habitat in the Pittwater Council LGA, and assign potential conflict categories.

Potentially suitable vegetation types, such as Coastal Sandstone Gallery Rainforest and Estuarine Swamp Oak Forest, were selected from OEH vegetation mapping *Native Vegetation of the Sydney Metropolitan Area* (OEH 2009). A full list of vegetation types selected as potential habitat is shown in 0.

Given the preliminary nature of this modelling, and the aim of identifying as much potential habitat in the developed areas of Pittwater Council, several generally preferred camp characteristics were excluded from the analysis (distance to water, elevation and slope). This has likely resulted in an overestimation of potentially suitable flying-fox habitat in the western, less developed areas of the LGA. Additional modelling and ground-truthing is recommended to improve map accuracy.

Following identification of potential habitat, an analysis was carried out to categorise the potential conflict according to distance to nearest residential area. Residential areas were identified via *Zones* data provided by Pittwater Council and all residential zone types were included. Potential habitat located within 50m of one of those residential zones was assigned as High potential conflict; habitat located 50m to 100m from residential zones was assigned as Moderate potential conflict; and habitat located more than 100m from residential zones was assigned as Low potential conflict.

A recent study showed that flying-foxes generally relocate within six kilometres of the original camp when dispersed (Ecosure and Griffith University, unpublished data). Therefore, a buffer of six kilometres has been added to Figure 5 to show the most likely initial relocation sites.

Figure 5 shows there is an abundance of potentially suitable habitat (with both low and high potential for conflict) nearby the Cannes Reserve, and in the LGA generally. Within 6km of Cannes Reserve there is:

- 516.3 ha of habitat with potential for high conflict (within 50m of a residential property)
- 83.6 ha of habitat with potential for medium conflict (between 50 and 100m of a residential property)
- 1401.1 ha of habitat with potential for low conflict (more than 100m from a residential property).

Within the entire Pittwater Council LGA, there is:

- 677.9 ha of habitat with potential for high conflict (within 50m of a residential property)
- 121.4 ha of habitat with potential for medium conflict (between 50 and 100m of a residential property)

- 3930.7 ha of habitat with potential for low conflict (more than 100m from a residential property).

Alternative habitat in relation to management of the Cannes Reserve camp is further discussed below.

More detailed maps of the five closest locations identified as having suitable habitat with low potential conflict habitat are provided in Appendix 4.

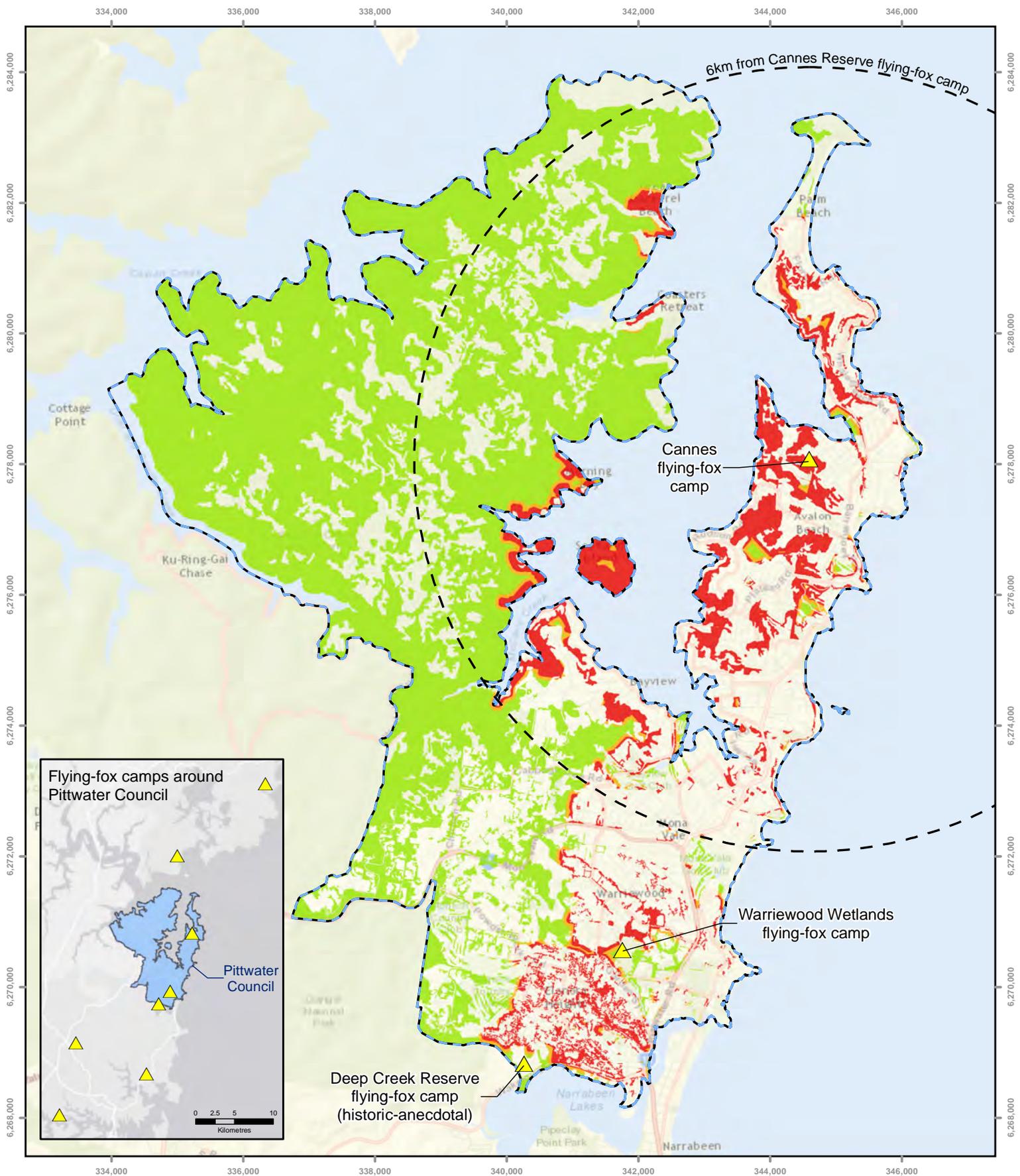


Figure 5: Potential flying-fox habitat within Pittwater Council LGA

Pittwater Council
Flying-fox camp management plan

- Flying-fox camp
- Pittwater Council boundary

Potential conflict

- High (<50m from residential areas)
- Moderate (50m - 100m from residential areas)
- Low (>100m from residential areas)



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0 0.5 1 2
Kilometres

GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter

5 Considered management options

In accordance with the draft NSW camp management policy (OEH 2014), camp management actions are categorised as:

- routine (Level 1) i.e. weed removal, mowing and ground-keeping, mulching.
- creation of buffers (Level 2) i.e. clearing or trimming canopy trees in the buffer, nudging
- camp disturbance or dispersal (Level 3) i.e. intentionally moving entire camps through vegetation clearing or disturbance.

Level 1 and 2 actions aim to mitigate impacts while allowing the camp to remain in situ, while Level 3 actions are aimed at intentionally dispersing the camp.

The following management options were investigated in identifying the planned management approach for the camp (with planned actions detailed in Section 7).

5.1 Level 1 and 2 actions (in situ management)

5.1.1 Buffers through vegetation removal

Vegetation removal aims to modify the habitat sufficiently so that it is no longer attractive or suitable as a camp. The amount of vegetation requiring removal varies between sites and particular camps; it may be as little as removing a weedy understorey (to alter the microclimate, reduce protection from predators and increase potential for disturbance) or as much as removal of the canopy. Restricting the canopy height to less than three to five metres will also make it less attractive to GHFF.

Removal of vegetation should be staged, with the aim of removing as little native vegetation as possible to achieve the desired result. For example, beginning with eliminating weeds, and then targeting vegetation that is most likely to sufficiently modify the roost habitat but have the least ecological impact. This is of particularly importance at this site, as it encompasses a number of ecological values (as detailed in Section 2). Heavy vegetation removal in the reserve is highly likely to impact on the endangered ecological communities present and therefore requires careful consideration and a cautious approach.

5.1.2 Buffers with deterrents

Permanent/semi-permanent deterrents may be installed to deter flying-foxes from a designated buffer area. Many deterrents have been trialled in the past with limited success, however the following options are worthy of further investigation:

- Python excrement – bagged snake excrement hung in trees has previously had localised effects. Logistical issues associated with sourcing and regularly applying large amounts of snake excrement would need to be overcome. The smell of large

amounts may also impact nearby residents. There is also the potential for flying-foxes to habituate to this deterrent.

- Visual deterrents – visual deterrents such as plastic bags, fluorescent vests and balloons (Ecosure personal experience) in roost trees have been shown to have localised effects (i.e. with flying-foxes avoiding roosting within 1-10 m). The type and placement of visual deterrents would need to be varied regularly to avoid habituation.
- Noise emitters on timers – noise needs to be random, varied and unexpected to avoid flying-foxes habituating. As such these emitters would need to be portable, on varying timers and a diverse array of noises would be required. It is likely to require some level of additional disturbance to maintain its effectiveness, and ways to avoid disturbing flying-foxes from desirable areas would need to be identified. This is also likely to be disruptive to nearby residents.
- Canopy-mounted water sprinklers – this method has been highly effective in deterring flying-foxes during dispersal of camps (Ecosure personal experience), and is the most likely to be successful. This option would however be logistically difficult (installation and water sourcing) and may be cost prohibitive, however is worthy of a trial.

Seven metre buffer

Modifying habitat within a seven metre wide zone around the perimeter of the Reserve has been investigated to create a buffer between residents and roosting flying-foxes (Figure 6).

The accompanying SIS (ELA 2012) has also been developed for these works. Completed works include weed removal (as per Stage 1 Section 6.1.1), and the removal of select roost trees in high conflict areas under relevant licences (0).

15 - 20 metre buffers

Buffers could be increased to approximately 15 – 20 metres from the Reserve edge, allowing flying-foxes only in the centre of the reserve (Figure 6). This would further increase the distance between roosting flying-foxes and residents, and also will limit the size of the camp, both of which will mitigate impacts to residents. This strategy may be combined with trialling/installing deterrents in the buffer zone to minimise impact on the EECs. Tall palms in the centre of the Reserve could also be made unattractive through heavy pruning, to encourage flying-foxes to roost below eye line of Cannes Drive residents.

Noise attenuation fencing could be investigated to complement this strategy (or replace it in areas).

Buffers of this size may change the microclimate and inadvertently cause the GHFF to abandon the camp. While the drainage line will assist maintaining microclimate stability, it may be beneficial to wait until the understorey has further regenerated following weed removal. This will also allow time for the canopy to partially recover from recent vandalism (where 2 x *Glochidion fernandi*, 2 x *Ficus coronata*, 1 x *Endiandra sieberi* and 1 x *Lugustrum lucidum* were removed illegally by an unknown person, which has also reduced roosting space in the centre of the Reserve and caused flying-foxes closer to some residents).

However, the removal of 20 metre buffers in such a small and linear reserve will likely impact severely on the EEC vegetation and potentially cause an irreversible decline in the ecological processes and integrity of this vegetation community.

Such wholesale removal of vegetation including canopy trees would also have immediate visual impact and would detrimentally affect the amenity and privacy of adjacent residences.

Nudging

'Nudging' refers to low intensity disturbance (using standard dispersal tools such as noise, smoke and visual deterrents, but at a lower intensity) to encourage flying-foxes to move away from certain areas of the camp (i.e. high conflict areas on residential boundaries). This should generally be done during the day to avoid inadvertent dispersal, but must be carefully planned to avoid welfare impacts. It often requires repeated effort to keep the flying-foxes in the preferred area.

Nudging is generally most relevant to large sites with substantial contiguous habitat away from conflict areas, and given the small area of the reserve is not recommended for the Cannes camp.

5.1.3 Noise attenuation fencing

Noise attenuation fencing could be installed in areas where the roost is particularly close to residents. This may also assist with odour reduction, and perspex fencing could be investigated to assist fence amenity. Although expensive to install, this option would negate the need for habitat modification, maintaining the ecological values of the site, and is likely to be more cost effective than ongoing dispersal.

5.1.4 Property modification

Dense planting to create screens at residential boundaries can assist reducing smell, noise and general amenity impacts. Species should be restricted to those that do not grow taller than five metres (or that can be maintained at less than five metres). Species that produce fragrant flowers may also be used as an additional odour buffer.

Species which attract foraging flying-foxes should also be avoided if faecal drop and noise during the night are causing concern. It is also important that residents recognise that impacts from foraging flying-foxes are independent of camp location. Staged removal of existing foraging tree species (those that produce edible fruit or nectar-exuding flowers) from residential yards, or management of fruit (i.e. bagging, pruning) will greatly assist in mitigating this issue.

Options to improve properties that will also reduce impacts of noise, odour and faecal drop also include installing:

- air conditioning
- car ports, covered areas or use of material that is easy to clean where faecal drop is an issue
- clothes dryers
- insulation and/or acoustic batts
- double glazed windows.

As demonstrated by the pending application by Pittwater Council for affected residents (Section 2.5), funding may be available for options such as this that allow the camp to remain in situ.



Figure 6: Considered management areas for Cannas Reserve camp

Pittwater Council
Cannas Reserve flying-fox camp management plan

- | | | |
|----------------------|-------------------------|--|
| Waterway | 7m buffer | Coastal escarpment littoral rainforest |
| Cannas Reserve | 15-20m buffer | Coastal moist spotted gum forest |
| Cadastral boundaries | Proposed retained roost | |



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GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter

5.2 Level 3 actions (dispersal)

There is a range of risks associated with dispersing a camp (compared with in situ management described above). These include:

- splintering the camp into other locations that are equally or more problematic
- shifting the issue to another area
- impact on animal welfare and flying-fox conservation
- impacts on the flying-fox population, including disease status and associated public health risk
- impacts to nearby residents associated with ongoing dispersal attempts
- high initial and/or ongoing resource requirement and financial investment
- negative public perception from community members opposed to dispersing/removing native vegetation
- Council may be legally liable for conflict arising from inadvertently moving the camp to another undesirable location
- unsuccessful management requiring multiple attempts, which may exacerbate all of the above.

Successful dispersal in Queensland have generally required either:

1. substantial vegetation removal/modification that may incur significant long-term ecological impacts on the camp area, or
2. regular disturbance at the site and intensive monitoring, with subsequent additional dispersal of flying-foxes from splinter camps that are considered unsuitable.

Each of the above dispersal approaches are very costly, require ongoing commitment and maintenance, are often not successful, and rarely result in desirable outcomes for all stakeholders (see Appendix 5). Dispersal also often leads to flying-fox stress, injuries or fatalities, and may lead to increased human health risk, nuisance issues, or human/flying-fox conflict at other sites.

5.2.1 Passive dispersal through vegetation removal

Removing vegetation in a staged manner can be used to passively disperse a camp, by gradually making the habitat unattractive so that flying-foxes will disperse of their own accord over time with little stress (rather than being more forcefully moved with noise, smoke, etc.). This is less stressful to flying-foxes, and greatly reduces the risk of splinter colonies forming in other locations (as flying-foxes are more likely to move to other known sites within their roost network when not being forced to move immediately, as in active dispersal).

Generally, a significant proportion of vegetation needs to be removed in order to achieve dispersal of flying-foxes from a camp or to prevent camp re-establishment. For example, flying-

foxes abandoned a camp in Bundall, Queensland once 70% of the canopy/mid-storey and 90% of the understorey had been removed (Ecosure unpublished, 2010). Ongoing maintenance of the site is required to prevent vegetation structure returning to levels favourable for colonisation by flying-foxes.

This option is preferable in situations where the vegetation is of relatively low ecological value and alternative known permanent camps are located nearby with capacity to absorb the additional flying-foxes. As the vegetation at Cannes Reserve is of high ecological (and amenity) value, there are very few known camps within the Pittwater area, and there is an abundance of similar habitat in residential areas that flying-foxes could establish new camps within, this approach is not recommended for the Cannes camp. Such an approach would also remove the ability to encourage flying-foxes back to the original site if the situation was made worse by the tools.

5.2.2 Active dispersal through disturbance

A range of tools can be used to actively disperse flying-foxes as they attempt to return to the roost after nightly foraging (see Appendix 6). Dispersal tools should be numerous and varied and used at unexpected locations to avoid flying-foxes habituating to dispersal.

Dispersal is more effective when a wide range of tools are used on a randomised schedule with animals less likely to habituate (Ecosure pers. obs. 1997 – 2015). Each dispersal team member should have at least one visual and one aural tool that can be used at different locations on different days (and preferentially swapped regularly for alternate tools). It is recommended there be at least two smoke drums/machines per dispersal site. Exact location of these and positioning of personnel will need to be determined on a daily basis in response to flying-fox movement and behaviour, as well as prevailing weather conditions (especially wind).

Active dispersal will be disruptive for nearby residents given the timing and nature of activities (see Section 8 for timing detail).

Additional risk management and welfare impact mitigation strategies are required for active dispersal, as detailed in Section 7.

While this method does not use habitat modification as a means to disperse the camp, if dispersal is successful and does not cause issues at other locations, habitat modification should be considered. This will reduce the likelihood of flying-foxes attempting to re-establish the camp and the need for follow-up dispersal as a result. Ecological and aesthetic values will need to be considered for this site, with options of modifying habitat the same as detailed for buffers in Section 5.1.

Estimated costs remaining for each management option are provided in Appendix 7. This includes current and planned management as detailed in Section 6.

6 Current and planned management actions

Following consideration of management options outlined in Section 5 Council has identified the following management approach that will be progressed during the five year life of this plan.

6.1.1 Stage 1 – removal of non-indigenous vegetation (Level 1 and 2 actions)

Non-indigenous vegetation is being progressively removed from the Reserve using best practice bush regeneration techniques. Objectives of this stage are to:

- rehabilitate the EECs (Level 1)
- remove weedy roost trees and alter the under and mid-storey in the buffer area to make high conflict areas of the camp less attractive (Level 2).

Initial works are almost complete under current licences (0), but assisted regeneration and weed management will be ongoing.

6.1.2 Stage 2 – buffers (Level 2 action) combined with active dispersal (Level 3 action)

Vegetation modification in the seven metre buffer zone (Section 5.1.2 and Figure 6) will be done concurrently with dispersal through active disturbance.

Canopy management is planned to continue in the 2015 non-breeding season (pending relevant approvals).

Works are to be carried out as the need arises depending on the presence and number of flying-foxes in the buffer zone. They are planned to mainly avoid peak mating (April-May), however some limited works may be done during this time. Measures to minimise potential impacts are detailed in Section 7.

A larger buffer of up to 20m was considered but deemed unsuitable given the impact on the EECs, including potentially making the remaining area unviable in the longer term. It was also considered unlikely that the community would generally support this level of vegetation removal, due to both environmental impacts and also loss of amenity and privacy for adjacent residences.

Habitat will be modified through vegetation removal in the seven metre buffer zone concurrently with an active dispersal trial for up to three weeks. This trial period will determine whether flying-foxes are likely to join other known camps without forming undesirable splinter colonies, and without increasing negative impacts at these alternative locations. Establishing a new camp in a low conflict area would also be a desirable outcome of the trial dispersal.

The purpose of creating buffers concurrently to dispersal is to:

- decrease the size and attractiveness of the camp habitat to reduce the likelihood of recolonisation attempts
- provide a buffer for residents if the dispersal trial is unsuccessful, and it is determined that flying-foxes need to return to the Reserve.

If the dispersal trial is successful and there are no undesirable effects elsewhere, Council may decide to continue making the site unattractive to roosting flying-foxes by:

- committing to follow-up dispersal (follow-up dispersal may be required each winter for the life of this plan)
- trialing deterrents, such as those detailed in Section 5.1.1.

Further habitat modification through vegetation removal will not be considered as part of this CMP.

A suitably experienced biologist should be on site during dispersal to ensure management is adaptive, based on flying-fox behaviour and response to actions.

Further detail on implementing these camp management actions (including timing) are outlined in Section 8. This includes measures to provide for animal welfare and conservation during management activities. Suitable dispersal tools are also provided in 0.

6.1.3 General management actions (Level 1)

Should the dispersal trial be unsuccessful and flying-foxes return to the Reserve, the following general management activities may be undertaken at any time during the life of the plan:

- mowing and maintenance around the camp
- removal of tree limbs posing a health/safety risk as determined by an arborist
- weed removal and other bush regeneration activities (in accordance with strategies to protect the GHFF detailed in the PoM)
- trimming understorey vegetation or planting vegetation
- minor habitat augmentation for the benefit of roosting animals
- mulching
- removing leaf litter or other material (i.e. rubbish).

7 Assessment of impacts

7.1 Seven metre buffer

The accompanying SIS (ELA 2012) assesses potential impacts associated with a buffer of up to seven metres.

7.2 Dispersal

An assessment of significance has been undertaken (see Table 2). The conclusion of this assessment is that dispersal of this camp is not likely to have a significant impact on the GHFF, which has been confirmed by OEH.

As per OEH advice the 2012 SIS also provides sufficient assessment of buffer creation and no additional SIS is required.

Table 2 Assessment of significance under the TSC Act.

Assessment of Significance criterion	Context
<p>a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction</p>	<p>Life cycle factors and viable local population</p> <p>This species is highly nomadic and travels long distances in response to flowering eucalypts and fruiting trees. Given this nomadic lifestyle, all GHFF individuals are considered to form part of a single population (OEH 2014 and DoE 2014).</p> <p>Juveniles are generally born in October/November and are carried with the females for several weeks and then left to crèche in the maternity camp while the mothers forage.</p> <p>The GHFF moves seasonally along the eastern coast of Australia, and regularly moves between camps.</p> <p>Assessment</p> <p>While this camp is continuously used, GHFF displaced from this camp will have numerous other locations to relocate to temporarily and for breeding. The use of a dispersal trial to determine flying-fox behaviour and movement also further protects the local population viability, and should flying-foxes form undesirable splinter colonies (which will also assist determining the importance of Cannes Reserve), dispersal will be abandoned and alternative management considered (i.e. permitting flying-foxes to return to the Cannes Reserve).</p> <p>Works will also be scheduled to avoid key periods of the life cycle.</p> <p>Given these considerations it is not likely that the proposed actions will result in the population of GHFF being placed at risk of extinction.</p>
<p>b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction</p>	<p>N/A</p>
<p>c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:</p> <p>i. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or</p> <p>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</p>	<p>N/A</p>

Assessment of Significance criterion	Context
<p>d) In relation to the habitat of a threatened species, population or ecological community:</p> <ul style="list-style-type: none"> i. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and ii. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and iii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality. 	<p>i. Extent of impact on habitat</p> <p>The aim of the dispersal program is to make the entire camp unsuitable for GHFF. It supports an average of 644 GHFF, but has been a temporary (one month in the winter of two years) refuge for up to 3500 GHFF (Figure 3).</p> <p>If dispersal appears to detrimentally impact the GHFF using the camp (by formation of splinter colonies/refusal to abandon the site during the three week dispersal trial), management options will be reconsidered to minimise impact (i.e. allowing GHFF to remain at the Reserve with buffers to mitigate amenity impacts on residents).</p> <p>ii. Habitat fragmentation</p> <p>Given the extensive potential habitat within the LGA (Figure 5), and a total of known six camp sites within the general area (Figure 4) of the Cannes Reserve, along with the transient and mobile nature of the GHFF, this dispersal is unlikely to cause any habitat fragmentation (i.e. restricted access to foraging habitat).</p> <p>iii. Importance of habitat to be impacted</p> <p>This Cannes camp does not qualify as a nationally important GHFF camp as defined in the draft EPBC Act Policy (DoE 2014), and, given the mobile and transient nature of GHFF, it is considered highly unlikely to be important to the survival of the population/species.</p>
<p>e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)</p>	<p>There are no areas of declared critical habitat that will be impacted by the actions in this plan.</p>
<p>f) Whether the action proposed is consistent with the objectives or actions of a Recovery Plan or Threat Abatement Plan</p>	<p>The draft national recovery plan for the GHFF (DECCW 2009) lists the following overall objectives:</p> <ul style="list-style-type: none"> · To reduce the impact of threatening processes on GHFF and arrest decline throughout the species' range. · To conserve the functional roles of GHFF in seed dispersal and pollination. · To improve the standard of information available to guide recovery of the GHFF, in order to increase community knowledge of the species and reduce the impact of negative public attitudes on the species. <p>It also has 13 specific objectives. This proposed action is inconsistent with one of these specific objectives:</p> <ul style="list-style-type: none"> · To protect and enhance roosting habitat critical to the survival of GHFF. <p>However, it is considered highly unlikely this habitat is actually critical to the survival of the GHFF (supported by criteria in DoE 2014) given the relative newness of the camp site, and small size.</p>
<p>g) Whether the action proposed constitutes or is part of a Key Threatening Process (KTP) or is likely to result in the operation of, or increase the impact of, a KTP</p>	<p>Removal of vegetation may contribute to one key threatening process relevant to this species: Clearing of native vegetation. However, removal of vegetation native to the area will be kept to a minimum, with selective trimming preferred for such species. The area proposed for habitat modification within the seven metre buffer is also very limited, which is further detailed in the accompanying SIS (ELA 2012).</p>

8 Dispersal strategy

8.1 Seasonal timing of management

As per standard conditions for flying-fox management approvals (OEH 2014), dispersal will not occur while females are visibly pregnant, birthing or when dependent young are present. Peak mating periods will also be avoided.

Figure 2 (Section 4) provides indicative timeframes of GHFF breeding cycle. However, as this is subject to change and out of season breeding is common, dispersal timing will avoid these critical times based on assessment by a person highly knowledgeable in flying-fox biology, ecology and behaviour, rather than through confinement to pre-determined times of the year.

Similarly, dispersal may occur during the GHFF breeding season (i.e. September – May) if such a knowledgeable person determines that breeding and animal welfare will not be impacted (i.e. females in final trimester/dependent young are not present). Dispersal during this time should be low intensity (i.e. smoke and recorded sounds played consistently only) to minimise the risk of stressing and impacting more susceptible individuals that may join the camp at any time (i.e. pregnant females, females carrying pups). Monitoring must be rigorous during dispersal at all times, but especially during times when these breeding animals may join the camp.

8.2 Daily timing of dispersal actions

Dispersal teams should be in position prior to flying-foxes returning to the camp. During winter in Sydney, flying-foxes will generally begin returning at between 0400 and 0430. As such, dispersal teams should be on site by 0330 and in position by 0345, with dispersal activities commencing as flying-foxes start returning (i.e. 0400). Active dispersal should continue for no more than three hours.

Triggers to cease dispersal before these seasonal and daily thresholds are detailed in Section 8.9 and 8.11.

8.3 Community consultation

The community will be informed of planned dispersal activities. Communication is planned to include:

- methods
- timeframes
- desired/acceptable outcomes
- program evaluation process (i.e. criteria for further dispersal/stop work triggers)
- contingency planning

- communicate appropriate procedures to follow in the event an injured, orphaned or dead flying-fox is located
- precautions to consider during dispersal
- contact information for the Program Coordinator.

Council will encourage the community to report unusual flying-fox behaviour or activity. Council staff fielding phone calls need to clearly identify whether flying-foxes were likely to have been roosting or foraging (i.e. by time of day/night), so that reports of foraging activity are not mistakenly investigated as possible new camps.

It is important that the community is aware not to interfere with management in any way, both from a statutory perspective but also to allow the program to be properly assessed without bias from any unknown activities (i.e. unauthorised dispersal).

As part of community consultation prior to works commencing, Council will also ensure all landowners have consented to the works, and provided permission to access properties where required.

8.4 Managing community impacts

Potential short-term impacts on surrounding residents associated with management activities include:

- sleep disruption between 0400 - 0730 on dispersal days
- stress to noise-phobic pets during dispersal
- irritation associated with smoke used for dispersal (residents should contact Council if this is likely to cause health impacts so that suitable planning can prevent ill effect)
- disturbance during vegetation management (possibly in the evening)
- increased flying-fox vocalising during the day.

Some level of impact is likely for residents within 150m of the roost, and possibly up to 300m. The most passive form of dispersal possible will be used, where noise is only made when flying-foxes attempt to land. This reduces the amount of noise required and is less stressful for the flying-foxes.

Residents will have contact details for the field team lead should any significant issues be experienced. The team lead will work with affected residents to minimise these issues as much as possible (i.e. adjusting methods where possible, etc.).

8.5 Human safety

Flying-foxes may carry pathogens that have the potential to cause disease in humans. Australian Bat Lyssavirus (ABLV) is a rabies-like virus that may be transmitted to humans through exposure to saliva of an infected flying-fox (or other bat). All known cases have been

through a bite or scratch, however exposure to mucous membranes (eyes, mouth) could potentially also lead to infection. While ABLV is fatal if it develops, effective pre- and post-exposure vaccinations and other simple measures to prevent the disease in humans are available.

Council and contractors will need to complete their own risk assessments to determine whether pre-exposure vaccinations are required. The following precautions should also be adopted:

- only appropriately trained and personnel with ABLV pre-exposure vaccinations, wearing puncture resistant gloves and forearm protection, are to attempt to handle or capture an animal
- all personnel to wear appropriate PPE: long sleeves and pants, eye protection and hat
- all personnel working underneath the active camp to wash clothes daily
- all personnel working underneath the camp during machine operations that aerosol the substrate (cause dust) to also wear protective breathing equipment (P3 breathing mask)
- appropriate hygiene practices must be adopted such as hand washing with soap and water before eating and smoking
- local public health authorities be made aware that the dispersal/vegetation management is occurring and that ABLV exposure may be possible
- if a person is bitten or scratched by a bat, the wound should immediately be washed with soap and water for at least five minutes, followed by application of an antiseptic with anti-viral action (i.e. Betadine) and immediate medical attention (post-exposure vaccinations may be required). Medical attention should also be immediately sought if a person is exposed to an animal's saliva or excreta through the eyes, nose or mouth.

Flying-foxes are also a natural host for HeV, which can be transmitted to horses. Infected horses have been known to amplify the virus and humans can be infected through close contact with an infected horse. There has been no recorded case of direct transmission of HeV from flying-foxes to humans. This disease is preventable with an effective vaccination available for horses.

Further information on bats and human health is provided by NSW Department of Primary Industries.

8.6 Animal welfare and conservation

The following general measures during all management activities will minimise the potential for animal welfare and population level impacts:

- a clear monitoring program with trigger points to stop works if required (as below)
- a wildlife carer and veterinarian on stand-by to accept injured or orphaned flying-foxes if required

- works timed to coincide with minimum numbers of flying-foxes at the camps if possible
- all personnel briefed prior to works commencing each day
- all personnel debriefed at the end of each day of works to allow methods to be adapted if required
- clear roles and responsibilities of all personnel on site (as below)
- communication maintained between all personnel on site at all times
- works timed to adverse climatic conditions where food and water availability may be limited
- works not undertaken on days when temperatures are predicted to reach more than 38°C (OEH 2014)
- works not scheduled when uncharacteristic seasonal conditions have resulted in a large proportion of the NSW flying-fox population temporarily occurring in one or a few local camps
- at least one day per week with no works/dispersal scheduled to allow flying-foxes to rest
- all personnel appropriately experienced, trained, and inducted to the program.

Removal of roost vegetation (tree removal/trimming) will ideally be done while flying-foxes are not present (i.e. after successful dispersal or at night when flying-foxes are away foraging). However, should vegetation management be required while flying-foxes are present, additional measures will be in place:

- a works buffer of at least 30m will be maintained between vegetation management works from any flying-fox roosting or in flight
- works will cease for the day if any individuals leave the Reserve area for five minutes or more
- works will cease for the day if 10% of flying-foxes take flight and remain flying for more than 10 minutes
- vegetation works will be carried out in a sequential manner, beginning at the furthest distance and moving towards the camp, in order to allow some level of habituation to noise and activity.

Works will be avoided during peak GHFF conception (April/May or as otherwise determined by a suitable expert), however if required to progress management in a timely manner some limited works (i.e. minor tree trimming) may occur during this time (but in accordance with the above measures). If works are required during the period of peak conception Council will avoid interrupting the breeding cycle by:

- ensuring works resulting in any disturbance are for only brief periods of the day (i.e. up to six hours in total, with at least one hour break)
- extending rest periods to two rest days per week.

8.7 Monitoring

A robust monitoring program around the dispersal is required to evaluate its success, ensure flying-fox welfare, and manage cascade risks (e.g. splinter colonies) in a timely and appropriate manner.

8.7.1 Methods

Static counts at the camp during the day are the simplest and most resource effective method of monitoring. These also allow an assessment of species composition, breeding status and body condition, which are not possible during a fly-out count.

Daily monitoring should include:

- species composition
- camp extent
- an estimate of available roost space remaining
- signs of morbidity or mortality
- breeding status i.e. whether pregnant flying-foxes in final trimester, independent young are present or mating behaviour is observed
- a total count of each species. Where parts of the camp are not visible and cannot be accessed, each roost tree that can be seen should be counted (including the proportion of each species) and then extrapolated to the estimated total number of roost trees/size of the camp to get a total count.

A pre-dispersal assessment should also include:

- body condition of individuals (where this can be visually assessed)
- flying-fox behaviour
- other information i.e. vegetation quality, etc.

Monitoring personnel shall be experienced in flying-fox identification and ecology, and they should be limited in number to reduce observer bias. There are also specific methods and software available that may be used to further standardise data (Westcott *et al.* 2011). Council and contractors will need to complete their own risk assessment to determine requirements for pre-exposure vaccinations against ABLV for personnel.

8.7.2 Sites and timeframes

All known camps within a 50 kilometre radius¹ should be monitored:

¹ This distance has been selected based on the 50km foraging radius of GHFF (see Section 4.1.2), as any location within 50km will have at least some overlap with the potential foraging area for the Cannes camp. It has also been used as there are few consistently used camps in any smaller radius.

- at least once prior to scheduling the dispersal, to ensure alternative camps are occupied (to indicate sufficient food resources nearby) and have capacity to accept dispersed animals
- on two consecutive days immediately prior to dispersal. These data can then be compared with counts during and following dispersal to provide an indication of flying-fox movement between camps.
- each day during dispersal
- at least weekly for two weeks following dispersal.

Suitable flying-fox habitat in close proximity to the dispersal sites, particularly at high conflict locations, should also be monitored daily. Relevant staff at local aerodromes (i.e. Palm Beach Water Airport) should be alerted to the program and encouraged to observe changes in flying-fox movement patterns and report back to Council.

Engaging the community to report unusual flying-fox sightings during and following the dispersal will assist in monitoring potential roost habitat within Pittwater Council.

A team member experienced in flying-fox ecology and behaviour will be present at Cannes Reserve during any management activity (active dispersal or vegetation management). This person will be vaccinated against ABLV and able to rescue any injured or orphaned flying-fox if required. They will also be responsible for monitoring flying-foxes for potential impacts and triggering appropriate action as detailed in Table 3.

Table 3 Guidelines for flying-fox monitoring immediately prior to and during dispersal and action if required

Potential impact	Signs	Action
Unacceptable levels of stress	<ul style="list-style-type: none"> • panting • saliva spreading • located on or within 2m of the ground • unusual vocalisations 	Works to cease for the day.
Fatigue	<ul style="list-style-type: none"> • low flying • laboured flight • settling despite dispersal efforts 	Works to cease for the day.
Injury/death	<ul style="list-style-type: none"> • a flying-fox appears to have been injured/killed on site (including aborted foetuses) • any flying-fox death is reported within one kilometre of the dispersal site that appears to be related to the dispersal • >5% adult females visually assessed to be in final trimester • dependent/creching young present • loss of condition evident 	Works to cease immediately and where any death or injury has occurred OEH must be notified AND rescheduled OR adapted sufficiently so that significant impacts (e.g. death/injury) are highly unlikely to occur, as confirmed by an independent expert (e.g. wildlife carer) OR stopped indefinitely and alternative management options investigated.

8.8 Roles and responsibilities

Roles and responsibilities for personnel involved in habitat modification and dispersal (Stage 2) are detailed in Table 4.

Table 4 Roles, responsibilities, authority and communication lines between the management team.

Role	Who	Responsibilities/authority	Communication lines
Program Coordinator	Council	<ul style="list-style-type: none"> · Inform and consult with the community and interested parties · Stakeholder consultation · Community consultation (including access permission, etc.) · Evaluate program · Determine management actions · Submit reports to OEH/DoE 	Reports to: Council Direct reports: Project Manager
Project Manager	Council/ Contractor	<ul style="list-style-type: none"> · Coordinate field teams and ensure all personnel appropriately experienced and trained for their roles · Induct all personnel to the program · Collect and collate data · Liaise with OEH and DoE · Liaise with wildlife carers/veterinarians (for orphaned/injured wildlife only) 	Reports to: Program Coordinator Direct reports: Team supervisors and team members
Supervisor*	Council/ Contractor	<ul style="list-style-type: none"> · Pre- and post-dispersal monitoring of all camps within a 50 kilometre radius · Surrounding camp monitoring during dispersal · Coordinate daily site briefings · Coordinate daily activities · Monitor flying-fox behaviour · Rescue flying-foxes if required (and no carer/vet on site) · Determine daily dispersal end point · Participate in management activities 	Reports to: Project Manager / Program Coordinator Direct reports: Team members
Team member**	Council/ Contractor	<ul style="list-style-type: none"> · Attend daily site briefings · Participate in relevant management activities (dispersal/vegetation management) 	Reports to: Supervisor Direct reports: Nil
Observer/support	Wildlife Carer/Veterinarian	<ul style="list-style-type: none"> · Provide care of injured/orphaned wildlife if required. 	Reports to: Supervisor Direct reports: Nil

*must be ABLV vaccinated, trained to rescue flying-foxes, experienced in flying-fox behaviour and all management actions.

**must be trained in flying-fox behaviour and preferably ABLV vaccinated. Recommended to have at least four on-ground staff for dispersal, plus standby personnel.

8.9 Program evaluation

In accordance with the PoM, the program will be continually reviewed as each stage is implemented, and success of each management stage detailed in Section 7 will be measured by its ability to:

- protect the welfare of GHFF during management activities
- provide residents with a reasonable level of amenity
- conserve the EEC
- adapt to new issues as they arise.

8.9.1 Dispersal success indicators

Guidelines for when the dispersal can be considered a success include when:

- after one season (12 months) without additional management there is an acceptably low number of flying-foxes on site
- newly established camps, or existing camps thought to have increased (as identified through monitoring), as a result of the dispersal activities:
 - are of sufficient area, nature and quality to support displaced flying-foxes
 - are located within 50km of current camp sites
 - are with sufficient vegetation cover to ensure that mortality from extreme weather conditions (e.g. heat related) are minimised
 - are considered in an acceptable location
- Council determines that impacts have been sufficiently mitigated
- negative impacts are not created or exacerbated at other locations (including neighbouring LGAs).

8.9.2 Dispersal program stop triggers

Dispersal will be permanently abandoned and alternative management strategies considered if:

- there is ongoing proliferation of splinter colonies in unsuitable locations
- impacts are created or exacerbated at other locations
- more than 50% of the total flying-foxes occupying the camp during pre-dispersal monitoring are still present at the camp after the three week dispersal trial
- more than seven follow-up dispersal programs² are required within 12 months at the principal camp site or any splinter camp sites
- allocated resources are exhausted.

² Follow-up dispersal is defined as an additional dispersal effort more than two weeks after full dispersal is achieved.

8.9.3 Splinter roost management

Where the decision is made to disperse a splinter roost, it will be done after a period of three days (unless risk is too great, in which case dispersal may occur immediately). This timeframe will prevent establishment at a new site, but will allow sufficient time to determine whether the site was a temporary refuge only that may be naturally abandoned.

Splinter roosts deemed unsuitable (using criteria above) will be dispersed concurrently with any dispersal at Cannes Reserve to allow for coordinated dispersal. Each splinter dispersal team will also have a team lead who is experienced and qualified to rescue flying-foxes if required, and monitor flying-fox behaviour to cease dispersal in accordance with Table 3 if required.

At least one dispersal team must be on stand-by at all times to disperse splinter colonies if required.

8.10 Costs

Appendix 7 shows anticipated costs associated with each management stage.

8.11 Timing

An overview of the planned management program is provided in Table 5. Note that dates are indicative only and exact timing may be adjusted within the general winter management timeframe.

Figure 7 provides a decision tool to assist guiding management following the three week dispersal tool.

Program evaluation following dispersal will be against objectives of the plan (Section 8.9) and dispersal success indicators (Section 8.9.1). Evaluation may occur anytime during the management program should a flying-fox be injured during management (Table 3) or with due to any stop work trigger (Section 8.9.2).

Table 5 Management program planned timing and program evaluation points. N.B. Dates are indicative only and may be adjusted within the general winter management timeframes.

Activity	2015																																				
	May		June																												July						
			Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	
		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7		
Pre-dispersal assessment (all known roosts within 50km) to inform management timing																																					
Program evaluation																																					
Community consultation																																					
Pre-dispersal monitoring																																					
Active dispersal - three week trial (~0400 - 0700)																																					
Vegetation management - 7m buffers*																																					
Daily monitoring (known roosts within 50km and nearby unsuitable habitat)																																					
Post-dispersal monitoring																																					

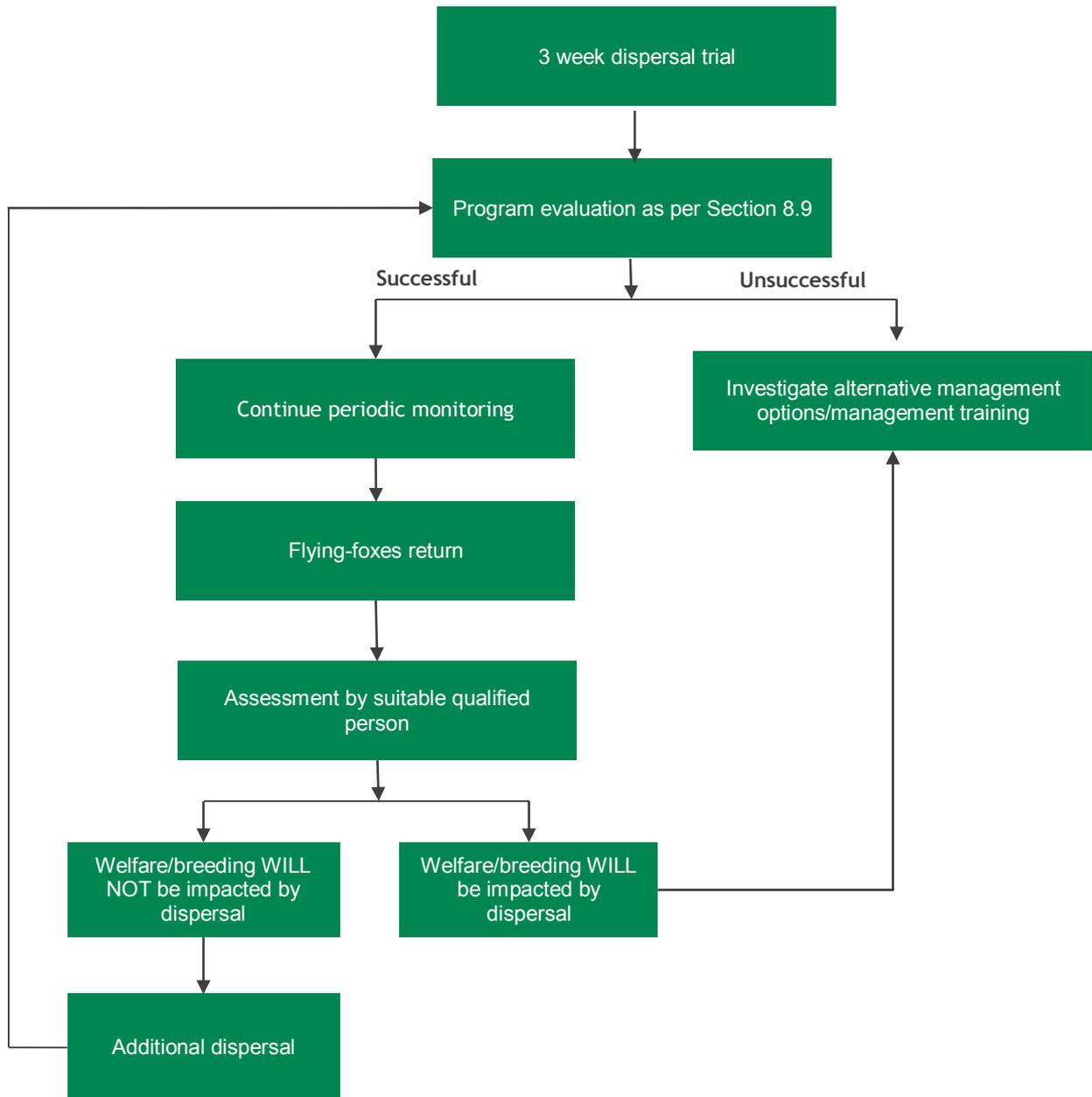


Figure 7 Decision tool to guide management following the three week dispersal trial

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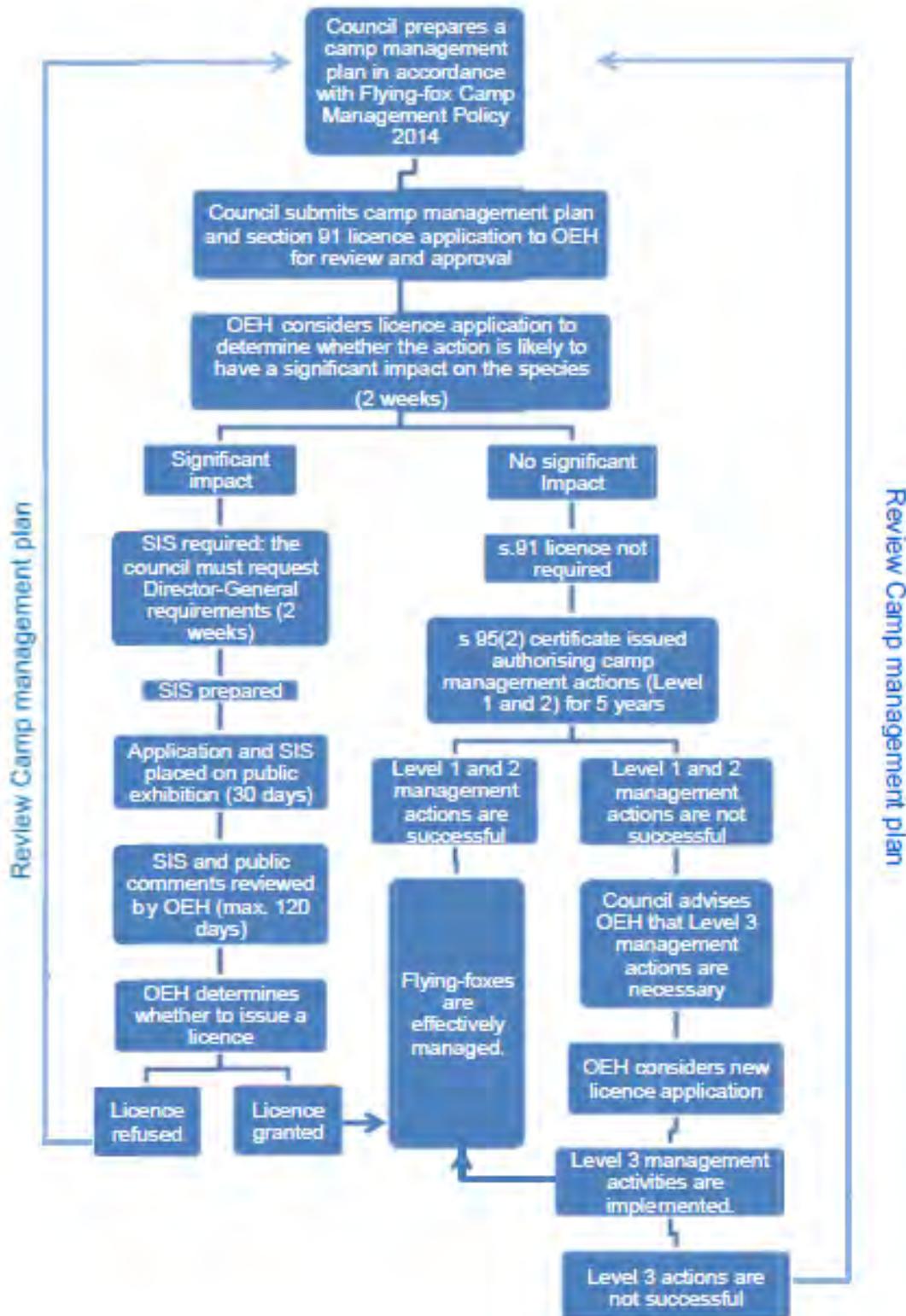
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Appendix 1 Process and timeframe for flying-fox camp management actions Source OEH 2014



Appendix 2 Licence summary

Date	Licence/Certificate
July 2010	Section 95C Certificate issued to Council to prune (mostly exotic) trees in Cannes Reserve and adjoining private properties
April 2011	Section 95C Certificate issued to resident to remove six Cabbage Palms
July 2011	Section 95C Certificate issued to Council to remove two Cheese Trees, one Kentia Palm cluster and one Silky Oak
July 2011	Section 95C certificate issued to resident to remove one Silky Oak, 5 Cannes Reserve
July 2012	Section 91 licence issued to Council and one resident to remove 4 Cheese Trees, 2 Cabbage Palms and exotic vegetation
December 2012	Section 95C Certificate variation issued to one resident to remove remaining trees that were not removed in July 2012
May 2013	Section 95C Certificate issued to Council to remove privets when camp empties. Given continuous occupation, privets drilled instead, June 2014
August 2014	Endorsement of Council Tree Preservation Officer approval of removal of 3 Cabbage Palms on 2 private properties.

Appendix 3 Vegetation types used for preliminary potential habitat mapping (Source OEH 2009)

Central Coast Escarpment Moist Forest

Coastal Alluvial Bangalay Forest

Coastal Diatreme Forest

Coastal Dune Littoral Rainforest

Coastal Enriched Sandstone Moist Forest

Coastal Escarpment Littoral Rainforest

Coastal Flats Swamp Mahogany Forest

Coastal Freshwater Swamp Forest

Coastal Headland Littoral Thicket

Coastal Sand Bangalay Forest

Coastal Sandstone Foreshores Forest

Coastal Sandstone Gallery Rainforest

Coastal Sandstone Gully Forest

Coastal Sandstone Riparian Forest

Coastal Warm Temperate Rainforest

Estuarine Mangrove Forest

Estuarine Swamp Oak Forest

Hawkesbury River Escarpment Dry Forest

Pittwater Spotted Gum Forest

Riverflat Paperbark Swamp Forest

Sydney Ironstone Bloodwood-Silvertop Ash Forest

Sydney North Exposed Sandstone Woodland

Urban Exotic/Native

Weeds and Exotics

Appendix 4 Potential alternative camp habitat nearby with low potential for conflict



Potential flying-fox camp habitat within Pittwater LGA with areas of low potential conflict (>100m from residential areas) – Stapleton Park

Pittwater Council
Flying-fox camp management plan

-  Pittwater Council boundary
-  Property boundaries



Job number: GW146
Revision: 0
Author: MED
Date: 02/04/2015



GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter



Potential flying-fox camp habitat within Pittwater LGA with areas of low potential conflict (>100m from residential areas) – Ku-ring-gai Chase National Park

Pittwater Council
Flying-fox camp management plan

-  Pittwater Council boundary
-  Property boundaries



Job number: GW146
Revision: 0
Author: MED
Date: 02/04/2015



GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter

345,000

345,200

345,400



6,278,800

6,278,600

6,278,400

6,278,200

6,278,800

6,278,600

6,278,400

6,278,200

Potential flying-fox camp habitat within Pittwater LGA with areas of low potential conflict (>100m from residential areas) – Hitchcock Park

Pittwater Council
Flying-fox camp management plan

 Pittwater Council boundary
 Property boundaries



Job number: GW146
Revision: 0
Author: MED
Date: 02/04/2015



GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter



Potential flying-fox camp habitat within Pittwater LGA with areas of low potential conflict (>100m from residential areas) – Bilgola / Attunga Reserves

Pittwater Council
Flying-fox camp management plan

-  Pittwater Council boundary
-  Property boundaries



Job number: GW146
Revision: 0
Author: MED
Date: 02/04/2015



GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter

343,600

343,800

344,000

6,277,000

6,277,000

6,276,800

6,276,800

6,276,600

6,276,600

6,276,400

6,276,400

343,600

343,800

344,000



Angophora Reserve

Hilltop Rd

Wandeen Rd

Bilwarra Ave



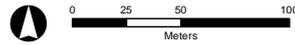
Potential flying-fox camp habitat within Pittwater LGA with areas of low potential conflict (>100m from residential areas) – Angophora Reserve

Pittwater Council
Flying-fox camp management plan

-  Pittwater Council boundary
-  Property boundaries



Job number: GW146
Revision: 0
Author: MED
Date: 02/04/2015



GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter

Appendix 5 Summary of previous dispersal attempts

Ecosure has managed nine flying-fox camp dispersals since 2010. In summary³:

- all individuals were successfully dispersed from the original camp in seven dispersals
- one or more new camps formed as a result of dispersal at five of these locations
- on three occasions the roost to which flying-foxes relocated created some community concern
- flying-foxes were moved an average of 2.6 km
- follow-up dispersal has been required to date at six of the original/new camps
- the average amount per initial dispersal was \$188,000 (all direct and indirect costs including assessment, permitting, equipment, lost time to other projects for council staff, etc.)
- the average amount per year of maintenance dispersal (where it was required) was \$66,000 (all direct and indirect costs including assessment, permitting, equipment, lost time to other projects for council staff, etc.)

The following table summarises all known flying-fox roost dispersals between 1990 and 2013⁴. N.B. These are all known dispersals during this period (not only Ecosure dispersals).

³ more detailed information cannot be provided without relevant client permissions.

⁴ Source: Roberts and Eby 2013, *Review of past flying-fox dispersal actions between 1990-2013*.

Location	Species	FF population estimate at time of dispersal	Method	Did the animals leave the local area?	Did the local population reduce in size?	How far did they move?	Were new roosts formed (number of new roosts if known)?	Number of separate actions	Cost (if known)	Was conflict resolved at the original site?	Was conflict resolved for the community?
Barcaldine, Qld	R	>50,000	VN	no	no	≈2 km	yes (1)	trees in township felled		yes	no
Batchelor, NT	B	200	BNS	no	no	<400 m	yes (1)	2		yes	yes
Boyne Island, Qld	BR	25,000	LNS	no	no	<500 m	yes (2)	3		yes	no
Bundall, Qld ⁵	GB	1580	V	uk	no	uk, but 7 roosts were within 5 km	no	1	\$250,000	yes	uk
Charters Towers, Qld	RB	variable	HLNPOW	no	no	200 m	no (returned to original site)	repeated since 2000	>\$500,000	no	no
Dallis Park, NSW	BG	28,000	V	no	yes	300 m	yes (1)	2		yes	no
Duaranga, Qld	R	>30,000	VNFO	no	no	400 m	yes	1	\$150,000	yes	uk
Gayndah, Qld	RB	200,000	VN	no	no	600 m	yes	3 actions, repeated		yes	no
Maclean, NSW	BGR	20,000	NS	no	no	350 m	yes (7)	>23	>\$400,000 and ongoing	no	o
Mataranka, NT	BR	>200,000	BHLNOSW	no	no	<300 m	uk	>9		no	no
North Eton, Qld	B	4800	VNFB	uk	no	<1.5 km initially	yes (≈4 majority temporary)	2	45,000	yes	yes (conflict at one site)

⁵ Bundall information amended from Roberts and Eby (2013) based on Ecosure's direct involvement and understanding of roost management activities and outcomes.

Location	Species	FF population estimate at time of dispersal	Method	Did the animals leave the local area?	Did the local population reduce in size?	How far did they move?	Were new roosts formed (number of new roosts if known)?	Number of separate actions	Cost (if known)	Was conflict resolved at the original site?	Was conflict resolved for the community?
Royal Botanic Gardens, Melbourne, Vic	G	30,000	NS	no	no	6.5 km	yes (2)	6 mths	\$3 million	yes	yes, ongoing management required
Royal Botanic Gardens, Sydney, NSW	G	3,000	LNPOW	no	no	4 km	no	ongoing daily actions for 12 mths	>\$1 million and ongoing	yes	yes
Singleton, NSW	GR	500	LNUW	no	no	<900 m	no (returned to original site)	>3	\$117,000 and ongoing	no	no
Townsville, Qld	BR	35,000	BNS	no	no	400 m	no (returned to original site)	5		no	no
Warwick, Qld	GRB (dispersal targeted R)	200,000	NLBP	no	no	≈1 km	no (site known to be previously occupied by GB)	5 days	\$28,000	yes	uk (complaints persisted until migration)
Young, NSW	L	<5000	VN	no	no	<600 m	yes (1)	uk		yes	no

* G = grey-headed flying-fox; B = black flying-fox; R = little red flying-fox; uk = unknown

B = "birdfrite"; F = fog; H = helicopter; L = lights; N = noise; P = physical deterrent; O = odour; S = smoke; U = ultrasonic sound; V = extensive vegetation removal; W = water.

Appendix 6 Dispersal tools

Table 6 outlines a range of management methods and dispersal tools that are available, and their suitability for Cannes Reserve. Methods below should be read with referral to general animal welfare considerations (Section 3.4).

Table 6 Assessment of management methods. Examples in green are known to be effective and should form the basis of the dispersal tool kit

Type	Examples	Level of historic success	Advantages	Disadvantages	Suitable for use at Cannes
Aural	Stock whips, starter pistols, distress callers, heavy music, air horns, banging metal objects, gas cannons, megaphones.	High (but requires ongoing effort).	Cost effective tools that are easily varied.	Costly operational costs (human resources). Risk of damaging flying-fox hearing – certain tools should not be used in close proximity to flying-foxes (i.e. BirdFrite).	✓
Visual	Lighting - hand-held spotlights, light towers, strobe lights.	Moderate (but requires ongoing effort).	Cost effective tools that are easily varied. Most effective in combination with audio tools.	Costly operational costs (human resources). Flying-foxes quickly habituate.	✓
	Laser pointers.	Moderate (but requires ongoing effort).	Cost effective tools. Most effective in combination with audio tools.	Risk of damaging flying-fox vision – laser power should be low range and should not be pointed at flying-foxes (but rather habitat). Care required where aircraft are operating nearby – see requirements of Civil Aviation Safety Authority.	✓
	General - dancing men, kites, balloons, plastic bags/reflective objects hung from branches.	Moderate – localised only (i.e. single tree or less).	Can remain in place for periods of time without human operation so no operational costs.	Installing to cover large enough areas can be logistically difficult and resource intensive. Flying-foxes may habituate quickly to some visual deterrents.	✓*

Type	Examples	Level of historic success	Advantages	Disadvantages	Suitable for use at Cannes
Physical	Water - hoses ⁶ , sprinklers (including canopy-mounted).	Unknown (but likely to be moderate-high).	Can be automated so minimal operational costs (water only).	Initial installation costly. Potential welfare implications associated with use of hoses.	✓*
	Trip wires.	Low (flying-foxes have been known to utilise trip wires as heavy duty roosting space).	Alternative wires to those used in the unsuccessful trial referenced may improve efficiency.	Risk of wildlife entanglement - requires proper installation, monitoring and maintenance to avoid.	✓*
	Netting.	Unknown (never trialled due to prohibitive cost and logistical issues).	Effective (physical exclusion).	Risk of wildlife entanglement - requires proper installation, monitoring and maintenance to avoid. Costly installation and maintenance. Reduced amenity. Logistically difficult to install in large areas. Reduced habitat value for other fauna.	✗
	Habitat modification.	High.	Effective. Reduced maintenance dispersal requirements and associated resource and welfare implications. Can be substituted for active dispersal/harassment techniques as a more passive method of dispersal i.e. vegetation management while flying-foxes are absent to a point that it is no longer attractive to roosting flying-foxes so that they voluntarily abandon the site.	Initially resource intensive. Reduced habitat value for other fauna. Potential for reduced amenity.	✓

⁶ Hoses should not be directed at flying-foxes for obvious welfare reasons, but can be used to deter flying-foxes from landing in a tree or re-establishing a roost.

Type	Examples	Level of historic success	Advantages	Disadvantages	Suitable for use at Cannes
	Culling.	Low (but ongoing effort required).	Not appropriate or permitted under current legislation.	Ineffective due to transient nature of flying-foxes. Welfare implications for target individuals (often inhumane death) and dependent young. Conservation implications with potential to impact flying-foxes at a population/species level. Would require euthanasia of injured (and potentially orphaned) animals. Increased disease risk with higher likelihood of humans coming in contact with dead, injured or orphaned flying-foxes.	X
Olfactory	D-Ter (manufactured by Heiniger), python excrement and the odour of paradichlorobenzene (found in toilet deoderiser blocks).	Moderate – localised only (i.e. single tree or less).	Can remain in place for periods of time without human operation so no operational costs.	Difficult and resource intensive to apply in large areas. Regular maintenance required.	X
Smoke	Smoke machine or fires contained in pits/drums.	High (but ongoing).	Effective.	Requires careful use ⁷ and monitoring to avoid welfare impacts. Heavily affected by weather conditions (rain, wind). Potential risk of bush fire. Potentially unsuitable during fire bans.	✓
General	Fogging.	High (but not appropriate).	Not appropriate	Use of oils (i.e. white oil) has potential for serious health impacts to flying-foxes.	X
	Aircraft i.e. helicopters.	Unknown (but not appropriate).	Not appropriate	Significant potential for strike resulting in human or wildlife injury/death.	X

⁷ Care should be taken when using smoke to ensure: fire must be extinguished should flying-foxes land in the area to avoid health impacts associated with smoke inhalation, and; materials that may produce harmful smoke or fumes when burnt are removed/not used (i.e. paint on drums, wood from toxic plants, petrol, etc.).

*May be suitable in some situations and/or if available resources allow.

Type	Examples	Level of historic success	Advantages	Disadvantages	Suitable for use at Cannes
	Paint ball guns.	Unknown (but not appropriate).	Not appropriate	Significant potential for wildlife injury/ death.	X
	Fireworks.	Unknown (but not appropriate).	Not appropriate	Significant potential for human or wildlife injury/death.	X

Appendix 7 Costs of management

The following table outlines anticipated costs to complete remaining actions over the life of the plan. NB: costs will be higher if management progresses beyond this five year period. Costs below include Council staff time, consultant and contractor costs and permit processing fees.

Cost sharing between stakeholders will be investigated during the pre-management consultation and consent period, and Council will be seeking a commitment by landholders to maintain private property.

Management activity	Est. remaining cost
Current or planned management activities (Section 6)	
General mitigation measures	\$4,000 + \$1,000 x 4 years
Education, phone calls, printing etc.	\$1,000/year
Planting vegetation buffer	\$4,000
Removal of non-indigenous vegetation (Stage 1)	\$3,840 x 4 years
Maintenance (per year)	\$3,840/year
7 metre buffers (Stage 2)	\$17,600 + \$2,880 per year x 4 years
On-ground works	\$17,600
Maintenance (per year)	\$2,880/year
Dispersal trial (assumes team of 5, 15 days dispersal over 3 weeks) (Stage 2)	\$60,930
OEH permit applications	\$1,280
Preparation (including community consultation)	\$2,400
Project management/admin	\$3,900
Project management during dispersal - fielding calls, media etc.	\$2,400
Dispersal lead (includes daily monitoring)	\$12,600

Management activity	Est. remaining cost
Dispersal team member (includes daily monitoring)	\$9,000
Dispersal team members	\$9,600
Dispersal disbursements - Accommodation (dispersal team)	\$3,000
Dispersal disbursements - Flights (return for dispersal team each week)	\$2,400
Dispersal disbursements - Meals (dispersal team)	\$1,500
Dispersal disbursements - Hire vehicle	\$1,200
Dispersal disbursements - Consumables, lighting hire etc	\$3,000
Monitoring - for scheduling	\$1,800
Post-dispersal monitoring	\$3,600
Monitoring disbursements - Accommodation (initial, pre-dispersal and post-dispersal)	\$1,000
Monitoring disbursements - Flights (initial and post-dispersal)	\$1,600
Dispersal disbursements - Hire vehicle	\$400
Monitoring disbursements - Meals (initial, pre-dispersal and post-dispersal)	\$250
Maintenance dispersal (assumes team of 3, 20 days total) (if required)	Average \$43,000/year x 4
Maintenance dispersal (per year) includes preparation, project management, community consultation, disbursements and consumables	\$26,000 - 60,000 ⁸ /year
Considered management options only (Section 5)	
Habitat modification entire camp (Considered management option only)	\$6,000/year x 4 years
7-20m buffers (Considered management option only)	\$30,000 + \$4000/year x 4 years

* total anticipated costs are based on the period of the plan, these are likely to be higher if management is to be continued.

⁸ Anticipated cost range accounts for varying personnel (i.e. lowest cost is Council staff time only and highest cost completely inclusive with all dispersal and equipment supplied by contractors).

A significant portion of remaining costs outlined in the table above will occur between plan approval and the 2015/16 period:

- Stage 1 (Removal of non-indigenous vegetation) = \$3,840
- Stage 2 (7 metre buffer works) = \$17,600
- Stage 2 (Dispersal trial) = \$80,032
- Stage 3 (Maintenance dispersal) = \$26,000 (assuming use of Council staff)

Total anticipated before end 2015/16 = \$127,472

Remaining costs for each year thereafter are anticipated to be:

- Stage 1 (Removal of non-indigenous vegetation) = \$3,840
- Stage 2 (7 metre buffer works) = \$2,880
- Stage 3 (Maintenance dispersal) = \$26,000 (assuming use of Council staff)

Total anticipated per year thereafter = \$32,720

Revision History

Revision No.	Revision date	Details	Prepared by	Reviewed by	Approved by
00	7/11/2014	Cannes Reserve flying-fox draft management strategy	Jess Bracks, Senior Wildlife Biologist	Phil Shaw, Managing Director	Phil Shaw, Managing Director
01	18/12/2014	Cannes Reserve flying-fox management strategy – final draft		Pittwater Council Jess Bracks, Senior Wildlife Biologist Phil Shaw, Managing Director	Phil Shaw, Managing Director
02	02/02/2015	Cannes Reserve flying-fox management strategy – final draft		Pittwater Council Jess Bracks, Senior Wildlife Biologist Phil Shaw, Managing Director	Phil Shaw, Managing Director
03	01/04/2015	Cannes Reserve flying-fox management strategy – final		Office of Environment and Heritage Pittwater Council Jess Bracks, Senior Wildlife Biologist	Leigh Knight, Senior Scientist
04	07/04/2015	Cannes Reserve flying-fox management strategy – final		Jess Bracks, Senior Wildlife Biologist	

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