Draft Raymond Terrace Flying-fox Camp Management Plan

July 2018| Port Stephens Council

Prepared by Hunter Councils Environment Division for Port Stephens Council

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We acknowledge input by the NSW Office of Environment and Heritage, and consultants Ecosure, in developing the template on which this Camp Management Plan was based. Peggy Eby also provided advice which was included in the template.

Version History

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Revised Draft (v7)	July 2017	Les Seddon	Revised draft for Council workshop
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Exhibition Draft	July 2018	Les Seddon	Final draft for exhibition

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Acronyms and Abbreviations

ABLV	Australian bat lyssavirus
BC Act	*Biodiversity Conservation Act 2016 (NSW)*
BFF	black flying-fox (*Pteropus alecto*)
DoE	Commonwealth Department of the Environment
DPI	Department of Primary Industries (NSW)
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPA	Environment Protection Authority (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
GHFF	grey-headed flying-fox (*Pteropus poliocephalus*)
the Guideline	Referral guideline for management actions in grey-headed and spectacled flying-fox camps 2015 (Commonwealth)
HeV	Hendra virus
LGA	local government area
LGNSW	Local Government NSW
LRFF	little red flying-fox (*Pteropus scapulatus*)
MNES	matters of national environmental significance
NPW Act	*National Parks and Wildlife Act 1974* (NSW)
NPWS	National Parks and Wildlife Service (NSW)
OEH	Office of Environment and Heritage (NSW)
PEPs	protection of the environment policies
the Plan	Camp Management Plan
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
the Policy	Flying-fox Camp Management Policy 2015 (NSW)
SEPPs	State Environmental Planning Policies
SIS	species impact statement
TEC	threatened ecological community
TSC Act	*Threatened Species Conservation Act 1995* (NSW)

Executive Summary

Flying-foxes first established a camp at Newbury Park, Raymond Terrace in summer 2011. Historically the camp has been primarily occupied by the grey-headed flying-fox (GHFF) with the population varying seasonally over time. In November 2014 the Flying-fox camp extended to Ross Walbridge Reserve, adjacent to Newbury Park. Both the park and reserve are owned by Port Stephens Council. Around mid-2016 the camp expanded significantly in what is believed to be linked to the mass flowering of Spotted Gums in the area that provided a significant food supply.

Little Red Flying-foxes (LRFF) were first observed in 2016 during the camp expansion but have always been a much less significant proportion of the camp. The destructive impacts of LRFFs experienced by other Councils have not been as significant an issue at Raymond Terrace.

The Raymond Terrace Flying-fox Camp is located adjacent to residential areas, approximately 700 metres east of Raymond Terrace shopping district, and is a cause of conflict and community concern due to noise, smell and excrement impacts, as well as potential health risk perceptions by the community.

GHFFs are listed as a threatened species under both NSW and Commonwealth legislation, and disturbance to flying foxes and their habitat is limited by legislative requirements. This species is highly mobile and camp populations vary widely over time due to food resource availability.

The Raymond Terrace Flying-fox Camp Management Plan (the Plan) provides a tool to ensure appropriate management of the camp. This management plan outlines the issues of concern to the community caused by the presence of flying-foxes, and the measures that will be taken to manage the land and reduce conflict with the local community. This approach may guide Council's approach in other locations in the local government area if flying-fox issues arise.

Experience in other areas has shown that attempts to move camps are generally unsuccessful, expensive, and likely to result in either the relocation and/or increase of problems. Therefore, management actions proposed at Raymond Terrace are primarily designed to minimise impacts from coexistence on residents.

Preparation of the Plan included a community survey of residents throughout the community; and consultation with the NSW Office of Environment and Heritage.

This Plan provides the framework for guiding Council's management actions on the land, and in responding to concerns of nearby residents.

Given the mobility of flying-foxes and the expected variability of the population of the camp over time, the focus of implementation actions is on:

- Awareness and preparedness for infrequent camp expansions to minimise odour impacts
- Mitigating impacts from faecal matter
- Avoiding disturbances to minimise excessive camp noise

In the event that the flying-foxes no longer occupy the site or are present in low numbers, then many of the actions identified in the Plan may not be required. Alternatively, if the number of individuals at the camp increases, then it may be necessary to review actions.

1 Overview

1.1 Background

This Plan has been developed as part of a Hunter Regional project that has developed Flying-fox Camp Management Plans (CMPs) for Cessnock City Council, Central Coast Council, Mid Coast Council, Muswellbrook Council, Singleton Council, Port Stephens Council and Upper Hunter Shire Council. Participating in this project has enabled strong alignment with the actions of other Councils and the creation of active working relationships with these Councils, so that if any management action undertaken affects the roosting behaviours of Flying-foxes in one jurisdiction, a network of land management / ecology specialists can notify neighbouring Councils of any possible increased Flying-fox movements.

The Plan has been prepared by Hunter Councils Environment Division and Port Stephens Council, utilising the NSW Office of Environment and Heritage's "Flying-fox Camp Management Plan Template 2016". In addition, input has been provided from all participating councils; the Office of Environment and Heritage; responses from community consultation and key stakeholders; and the 2014 Newbury Park Vegetation Management Plan.

The Plan has been prepared to identify management actions suitable for Council's use that may reduce the impact of flying foxes on residents, particularly adjacent to the land occupied by the camp, while maintaining suitable habitat on the site to support the population of the grey-headed flying-fox, a listed threatened species. The plan also provides general guidance throughout the Port Stephens local government area for flying-fox camps.

The purpose of this plan is to undertake camp management in accordance with the Office of Environment and Heritage (OEH) Flying-fox Camp Management Policy (OEH 2015). The plan has been prepared in consultation with OEH. If approved by OEH (in combination with other relevant license applications and legislative requirements) this Plan will enable appropriate vegetation management on the land under NSW state legislation to reduce impacts of the camp on residential areas.

In April 2018 the NSW Government consulted on a *Draft Code of Practice Authorising Flying-fox Camp Management Actions*. The draft code is intended to provide councils with greater management flexibility and opportunities to be more proactive in camp management. Future decision making and activity under the potential code will still require the existence of Camp Management Plans that are necessary to establish and acknowledge the ecological benefits of camps, community expectations and the heavy burden placed on local residents to inform decision making.

The plan outlines how the land occupied by the camp will be managed, and actions that Council will take to reduce residential impacts as far as possible. Little or no direct impact to flying-foxes arising from the proposed management actions is anticipated, and no license is therefore expected to be required. The plan operates for 5 years.

1.2 Objectives

Council has developed this Flying-fox Camp Management Plan to provide Council, and the community a clear framework for the management of the Raymond Terrace Flying-fox Camp.

The objectives of this Camp Management Plan (the Plan) are to:

- minimise impacts to the community, while conserving flying-foxes and their habitat
- enable land managers and other stakeholders to use a range of suitable management responses to sustainably manage flying-foxes

The Plan provides details on the camp site, flying-fox species, community inputs, management opportunities and agreed management actions designed to achieve the above stated objectives.

The objectives of the Plan are consistent with the Office of Environment and Heritage Flying-fox Camp Management Policy (OEH 2015).

2 Context

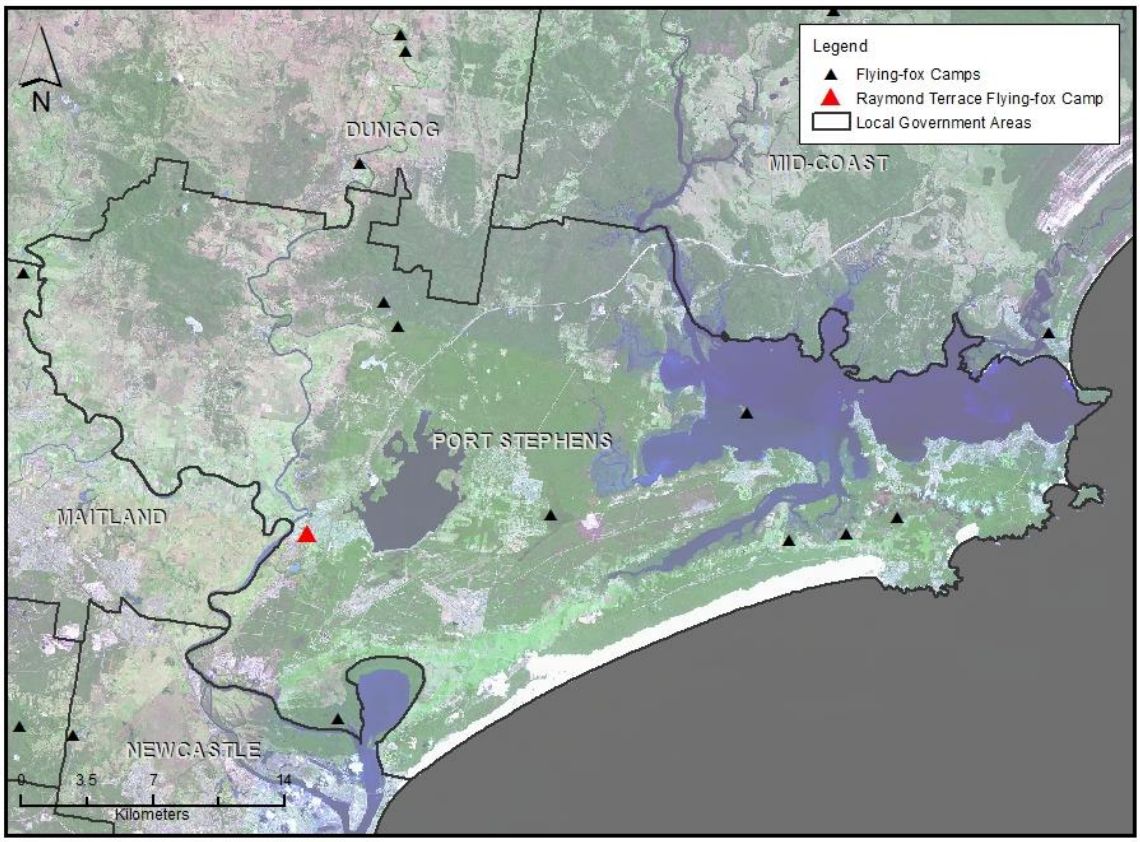
2.1 Local Context

Port Stephens Local Government Area currently supports nine (9) known flying-fox Camps (refer Figure 1). The Raymond Terrace Flying-fox Camp (the Camp) is situated in close proximity to residential development and is the only constantly utilised flying-fox camp in the LGA, and is the subject of this CMP. The Camp population on average contains 8,000 individuals (of three different species) with a maximum record of 21,000 in April 2016.

Other flying-fox camps in the local government area include:

- Anna Bay, Tomago (Fullerton Cove), Wallaroo NP (Italia Rd) and North of Italia Road; where camps have had no records, suggesting these are historical Camps as no animals were present on site during the CSIRO census counts.
- Bob's Farm (two Camps 3km apart); where a large number of animals were recorded in 2015, but no other evidence of sustained Camp usage has been recorded
- Medowie; where animals were recorded in 2013 and 2014, but in no other year
- Schnapper Island; where a small number of animals were observed roosting in 2014.

Figure 1 Port Stephens Local Government Area



2.1.1 Raymond Terrace Flying-fox Camp and Surrounds

Newbury Park at Raymond Terrace has supported a flying-fox camp since 2010. There had been little conflict with nearby residents up until September 2013 when the Flying-fox population exceeded 10,000 animals when complaints to Council escalated. The Camp has been permanently occupied since 2013 and due to the number of animals consistently utilising the site, it was designated a Nationally Significant Flying-fox Camp (see Section 2.3 Legislative and Regulatory Context for more details).

Newbury Park is a 2.23ha, triangular drainage reserve situated in Raymond Terrace between Adelaide Street in the north, Mount Hall Road and Thomas Street in the south and adjacent to residences in both Thomas Street (south) and Hillside Close to the east (Figure 2).

Ross Walbridge Reserve is a much larger, approx. 10 ha, parkland reserve and is located across the road (on the north-western side) of Adelaide Street. Ross Walbridge reserve contains a water body with three islands. It is bordered by William Bailey Street on the west side and Newline road on its northern border (refer Figure 2). There are equine facilities and residential houses on the eastern side, sports complex to the north and business and retail to the west.

The park's drainage catchment is approx. 16ha. This drainage area is predominantly to the south and east and is residential.

The vegetation is dominated by Paperbark species and Swamp Oak. There is a dense lower, mid-storey and upper canopy except for where the flying-foxes have been roosting regularly causing some defoliation (mostly in the mid to upper canopy).

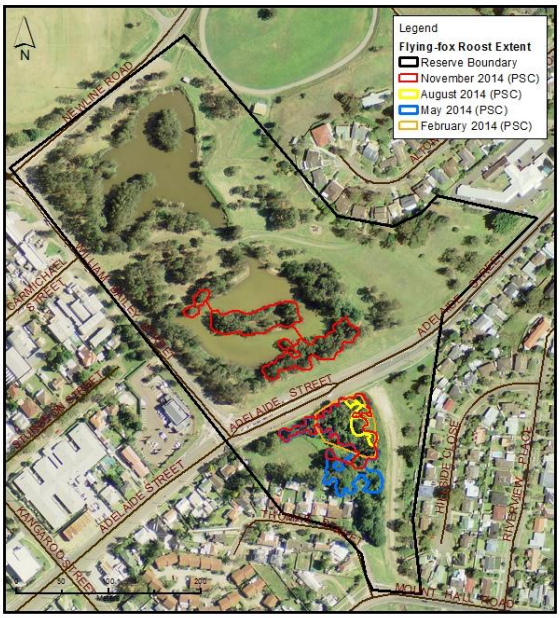
The extent of roosting areas has spanned both Newbury Park and Ross Walbridge Reserve, with both Council reserves zoned as recreational land. Figure 2 shows the maximum extent of where Flying-foxes have roosted over the past 7 years. Figure 4 shows the changing extents of occupancy.

Figure 2 Raymond Terrace Flying-fox Camp location and historical extent

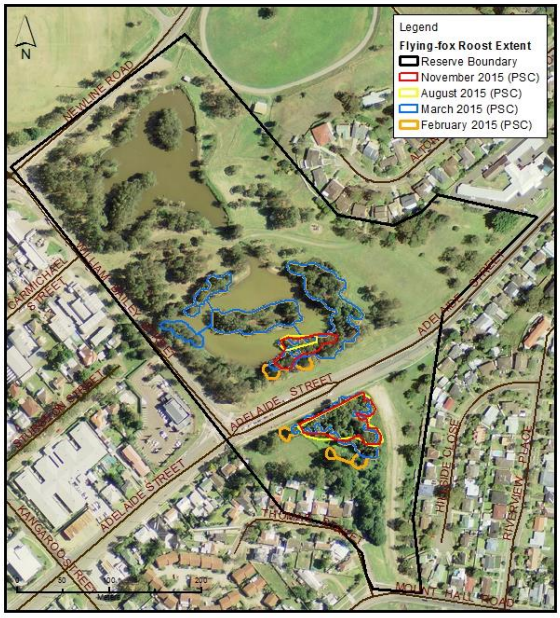
Figure 3 Historical extent of camp occupancy

Roosting location 2013

Roosting location 2014



Roosting location 2015



Roosting location 2016

There has been a marked change in roosting behaviour since Camp inception where the initial Camp was located entirely in Newbury Park, but as flying-fox numbers have increased, the camp has extended and is now utilising a large area of Ross Walbridge Reserve.

The Camp predominantly provides roosting for Grey-headed Flying-foxes, although a small number of Black Flying-foxes have been observed on the site. The first observations of Little Red Flying-foxes utilising the Camp was in 2016.

2.1.2 Flying-fox Population & Statistics

Details on the national flying fox population, statistics and threatened species status is provided in Appendix 1.

The Grey-headed Flying-fox population at the Raymond Terrace Camp is relatively stable, but does usually experience some increase in population between February and May each year (typically associated with mating season).

Table 1 provides population details as published in the CSIRO National Flying-fox Census. Figure 4 provides a graphical presentation of the data presented in Table 1, showing the increased numbers of Flying-foxes utilising the Raymond Terrace Flying-fox Camp, causing it to gain the designation as a Nationally Important Flying-fox Camp. It is noted that this quarterly data resolution does not accurately reflect fluctuations in occupancy compared to Council's monthly monitoring.

Figure 5 provides monthly occupancy numbers from Council monitoring which shows the relative roosting change over the past few years, clearly showing the Camp expansion from Newbury Park to Ross Walbridge Reserve.

Flying-fox occupancy numbers peaked in April and May 2016, coinciding with mass winter eucalypt flowering events in the Hunter Valley, and have been at their lowest in July 2018 since monthly monitoring began in 2015.

Table 1: Flying-fox population data (source: CSIRO National Flying-fox census).

	Nov-12	Feb-13	May-13	Aug-13	Nov-13	Feb-14	May-14	Aug-14	Nov-14	Feb-15	May-15	Aug-15	Nov-15	Feb-16	May-16	Aug-16
Hunter Camps	15,387	131,768	44,519	23,649	15,172	97,769	27,533	7,681	130,269	335,279	105,926	112,624	138,593	309,962	176,703	66,784
Raymond Terrace Camp - GHFF	0	1,500	4,096	6,564	715	1,619	5,770	1,150	8,761	10,767	10,522	5,476	2,700	1,820	5,500	5,355
Raymond Terrace Camp - LRFF	0	0	0	0	520	0	0	0	0	0	0	0	0	0	0	0
Raymond Terrace Camp - BFF	0	0	0	560	65	16	58	61	0	0	0	0	0	0	0	0
% of Hunter Region FF in Raymond Terrace	0%	1.1%	9.2%	30.1%	8.6%	1.7%	21.2%	15.8%	6.7%	3.2%	9.9%	4.9%	1.9%	0.6%	3.1%	8%

GHFF = Grey Headed Flying-fox; LRFF = Little Red Flying-fox; BFF = Black Flying-fox

Figure 4: Graph of Flying-fox census results for the Raymond Terrace Flying-fox Camp (source: CSIRO National Flying-fox census)

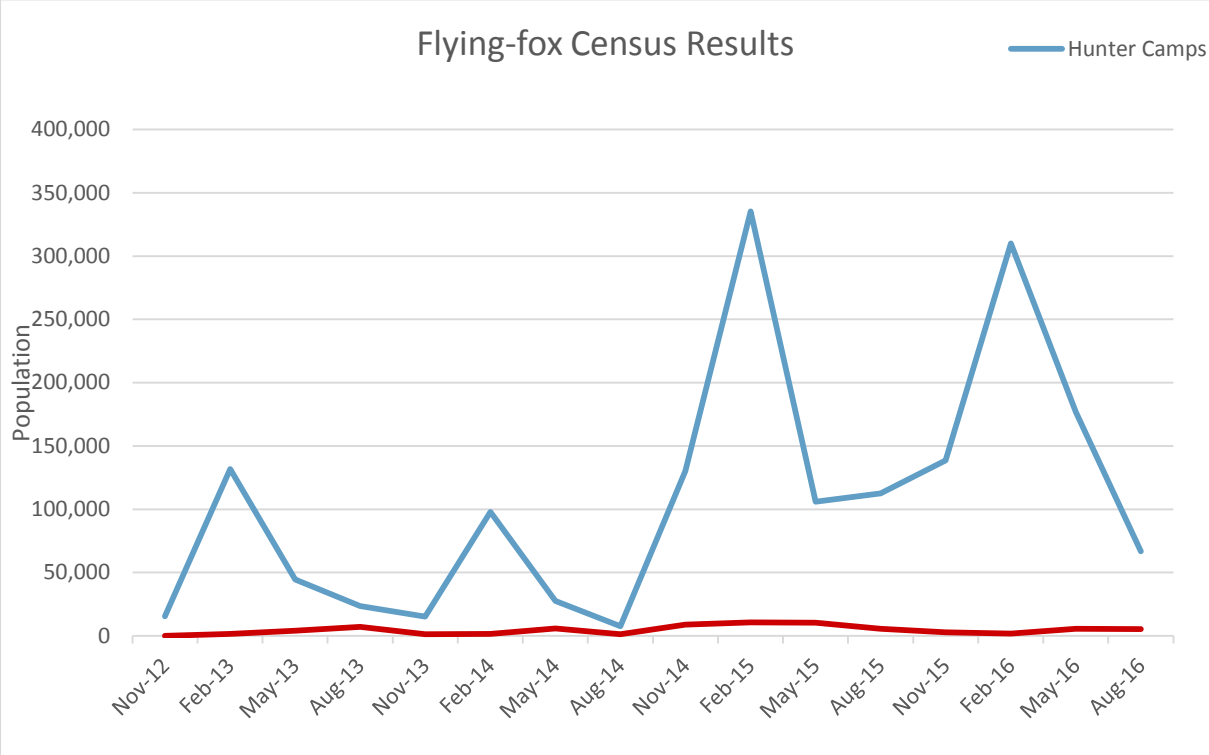
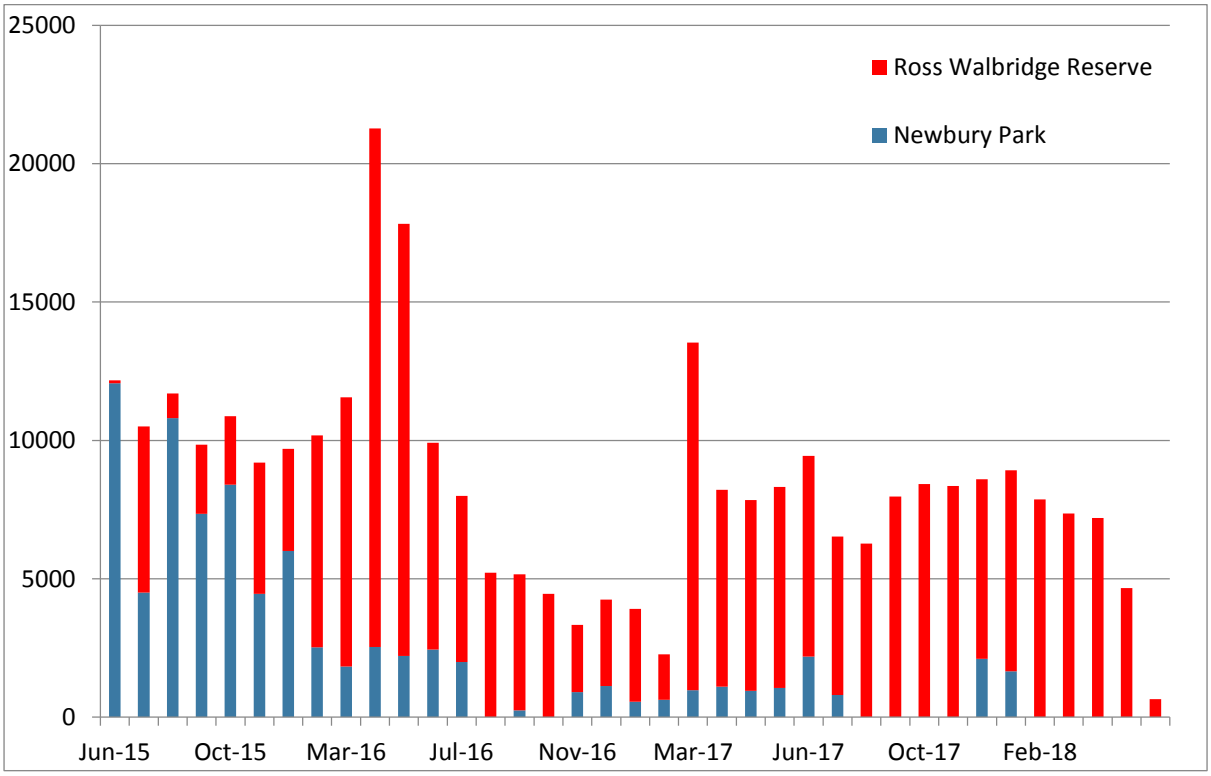


Figure 5: Flying-fox population across both Newbury Park and Ross Walbridge Reserve since June 2015



2.1.3 Community Interests and Issues Related to the Camp

The community has shared both positive and negative feedback about the Camp. Information has been collected via a range of reporting and consultation methods. Further discussion about community engagement efforts and outcomes can be found in Section 3.

Reported negative issues include:

- noise as flying-foxes depart or return to the camp
- noise from the camp during the day, especially during the March to May breeding period and during disturbance from users and management of the parks
- faecal drop on outdoor areas, cars and washing lines, and residents resources (time and financial cost) associated with cleaning areas adjacent to the camp
- odour, including associated health impacts
- fear of disease
- health and/or wellbeing impacts (e.g. associated with lack of sleep, anxiety)
- reduced general amenity from constraints on utilising the park, backyards and keeping windows and doors shut

The majority of reported issues related to the camp are recorded from around March to June in 2016, and to a lesser extent 2017. This tends to coincide with an increase in flying-fox numbers during regional flowering events coinciding with the breeding season.

The majority of issues recorded are related to odour and excrement impacts to the residents in Alton Close directly to the north east of the camp. However, odour events are experienced all around the camp depending on moisture and wind directions. Properties throughout Raymond Terrace have localised impacts where small foraging resources, such as Cocos Palms, are found in back yards.

Council is improving its formal tracking of complaints and received dozens of direct telephone complaints and numerous written complaints since the camp expansion in 2016. Prior to that less than a dozen complaints were received per year.

There are also people in the surrounding area who enjoy the camp and would prefer it is not managed/managed in situ. Reported positive feedback stems from people who:

- recognise the landscape-scale benefits flying-foxes provide through seed dispersal and pollination
- acknowledge the need to conserve flying-foxes as an important native species
- enjoy watching flying-foxes at the camp and/or flying out or in
- appreciate the intrinsic value of the camp
- appreciate the natural values of the camp and habitat
- recognise the need for people and wildlife to live together.

2.1.4 Management Response to Date

The Newbury Park Vegetation Management Plan (VMP) was developed and finalized in 2014 in response to a surge in complaints following expansion of the normally stable population in Newbury Park in mid-2013. The Newbury Park VMP provided the basis to secure an s95 License (as required by s91 of the Threatened Species Conservation Act 1995). Specific works undertaken (and the subject of the license) were:

- Removal of 16 mature Jacaranda trees (*Jacaranda mimodisolia*), Slash Pine (*Pinus elliotii*), Coral Tree (*Erythrina sp*.), Willow (*Salix sp*.), Camphor Launrel (*Cinnamomum camphora*) and Box Leaf Elder (*Acer sp*.) from 0.12 hectares along the southern boundary of residential dwellings. The tree removal created a treeless buffer between residential dwellings and the Flying-fox roosting area (designed to remove the possibility of Flying-foxes roosting in residential yards).
- Planting low-growing herbaceous indigenous plants and shrubs in the buffer zone to prevent flying-foxes roosting in the buffer zone
- Removal of exotic vine and shrubs from 0.19 hectares of the park (area utilised by Flying-foxes to roost).

- Planting a selection of indigenous trees, shrubs, forb, and herb species over 0.2 hectares immediately to the west of the remnant vegetation in Newbury Park to ultimately enlarge the area of roosting habitat available in Newbury Park.
- Planting of indigenous trees and shrubs on the eastern, northern and western boundary of the remnant woody vegetation to increase the roosting habitat in Newbury Park.

2.2 Ecological Values of Flying Foxes, the Camp and Surrounding Areas

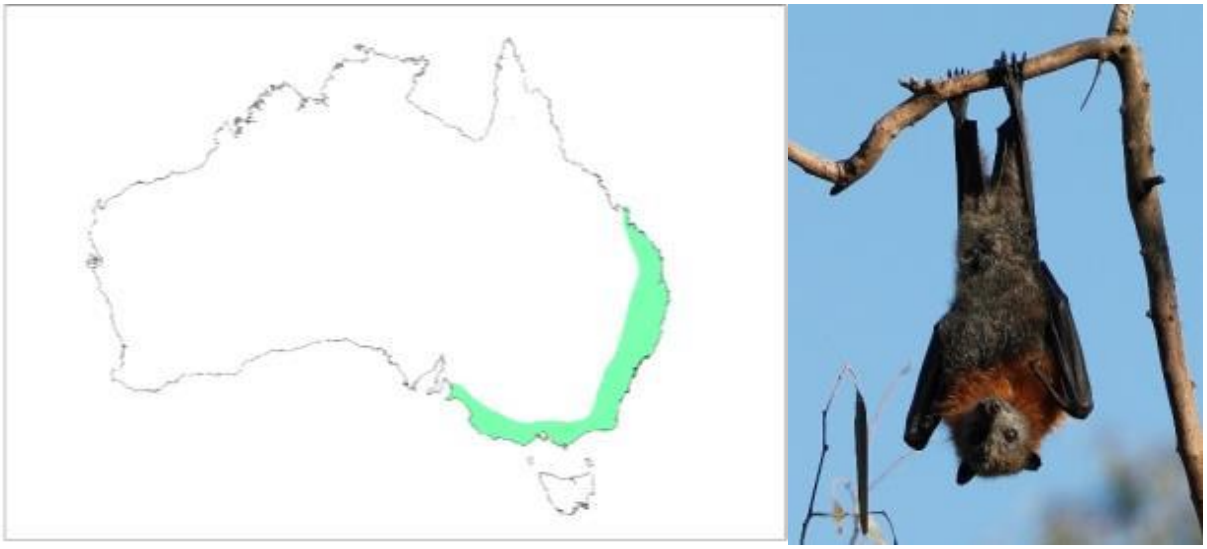
2.2.1 Flying-fox Species utilising the Raymond Terrace Flying-fox Camp

Three main species of Flying-fox have been observed roosting at the Raymond Terrace Flying-fox Camp, details on each species follows.

Grey-headed flying-fox (*Pteropus poliocephalus*)

The grey-headed flying-fox (GHFF) (Figure 6) is found throughout eastern Australia, generally within 200 kilometres of the coast, from Finch Hatton in Queensland to Melbourne, Victoria (OEH 2015d). This species now ranges into South Australia and has been observed in Tasmania (DoE 2016a). It requires foraging resources and camp sites within rainforests, open forests, closed and open woodlands (including melaleuca swamps and banksia woodlands). This species is also found throughout urban and agricultural areas where food trees exist and will raid orchards at times, especially when other food is scarce (OEH 2015a).

Figure 6: Grey-headed flying-fox indicative species distribution, adapted from OEH 2015a



All the GHFFs in Australia are regarded as one population that moves around freely within its entire national range (Webb & Tidemann 1996; DoE 2015). GHFF may travel up to 100 kilometres in a single night with a foraging radius of up to 50 kilometres from their camp (McConkey et al. 2012). They have been recorded travelling over 500 kilometres over 48 hours when moving from one camp to another (Roberts et al. 2012). GHFFs generally show a high level of fidelity to camp sites, returning year after year to the same site, and have been recorded returning to the same branch of a particular tree (SEQ Catchments 2012). This may be one of the reasons flying-foxes continue to return to small urban bushland blocks that may be remnants of historically-used larger tracts of vegetation.

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; Roberts et al. 2012). This results in large fluctuations in the number of GHFFs 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 2000). They are widespread throughout their range during summer, but in spring and winter are uncommon in the south. In autumn they occupy primarily coastal lowland camps and are uncommon inland and on the south coast of NSW (DECCW 2009).

There is evidence the GHFF population declined by up to 30% between 1989 and 2000 (Birt 2000; Richards 2000 cited in OEH 2011a). There is a wide range of ongoing threats to the survival of the GHFF, including habitat loss and degradation, deliberate destruction associated with the commercial horticulture industry, conflict with humans, infrastructure-related mortality (e.g. entanglement in barbed wire fencing and fruit netting, power line electrocution, etc.) and competition and hybridisation

with the BFF (DECCW 2009). For these reasons it is listed as vulnerable to extinction under NSW and federal legislation (see Section 2.3).

Little red flying-fox (*Pteropus scapulatus*)

The little red flying-fox (LRFF) (Figure 7) is widely distributed throughout northern and eastern Australia, with populations occurring across northern Australia and down the east coast into Victoria.

Figure 7: Little red flying-fox indicative species distribution, adapted from OEH 2015a

The LRFF forages almost exclusively on nectar and pollen, although will eat fruit at times and occasionally raids orchards (Australian Museum 2010). LRFFs often move sub-continental distances in search of sporadic food supplies. The LRFF has the most nomadic distribution, strongly influenced by availability of food resources (predominantly the flowering of eucalypt species) (Churchill 2008), which means the duration of their stay in any one place is generally very short.

Habitat preferences of this species are quite diverse and range from semi-arid areas to tropical and temperate areas, and can include sclerophyll woodland, melaleuca swamplands, bamboo, mangroves and occasionally orchards (IUCN 2015). LRFFs are frequently associated with other *Pteropus* species. In some colonies, LRFF individuals can number many hundreds of thousands and they are unique among *Pteropus* species in their habit of clustering in dense bunches on a single branch. As a result, the weight of roosting individuals can break large branches and cause significant structural damage to roost trees, in addition to elevating soil nutrient levels through faecal material (SEQ Catchments 2012).

Throughout its range, populations within an area or occupying a camp can fluctuate widely. There is a general migration pattern in LRFF, whereby large congregations of over one million individuals can be found in northern camp sites (e.g. Northern Territory, North Queensland) during key breeding periods (Vardon & Tidemann 1999). LRFF travel south to visit the coastal areas of south-east Queensland and NSW during the summer months. Outside these periods LRFF undertake regular movements from north to south during winter–spring (July–October) (Milne & Pavey 2011).

Black Flying-fox (Pteropus Alecto)

The Black Flying-fox is almost completely black in colour, relieved only by an incomplete rusty-red collar and a light frosting of silvery grey on the belly. It can be distinguished from the Grey-headed Flying-fox by its greater size, darker colour and bare legs.

The BFF live is large communal day-time camps in remnants of coastal subtropical rainforest or swamp forest, often with Grey-headed Flying-foxes. They fly out at dusk to feed on rainforest fruits as well as nectar and pollen from flowering eucalypts, paperbarks and banksias. When native foods are scarce, particularly during drought, they take fruit from orchards.

2.2.2 Raymond Terrace Flying-fox Camp Description

As described in Figure 2 there is a Flying Fox colony roosting in two different council reserves:

Newbury Park is a 2.23ha triangular drainage reserve situated south of Adelaide Street that has supported a Flying Fox Colony since 2010 (Port Stephens Council 2014). The reserve is surrounded by residential dwellings on Thomas Street along the southern and south-western boundary. The western side of the reserve is bound by an unsealed road and a row of residential properties on Hillside Street. Newbury Reserve is approximately 14km from the coast.

The dominant habitat features of Newbury Park include Swamp-oaks, ferns, and woody and wiry vines. Past clearing and widespread weed infestation has resulted in limited species diversity in the canopy, mid story and ground layers. Swamp-oak dominates the canopy, providing suitable Flying-fox roosting habitat. Species recorded along the eastern boundary of the reserve include Red Ash and Prickly-leaved Tea Tree. The main vegetation community is Swamp Oak Forest / Rushland, the species present indicate that the vegetation community is associated with the Swamp oak Floodplain Forest, listed as an Endangered Ecological Community.

Newbury Park is best described to be in moderate condition, as much of the reserve has been degraded as a result of past clearing and extensive weed invasion. Within the core of the reserve, there may be opportunity for effective restoration and rehabilitation following comprehensive weed control.

There are no formal walking tracks through the reserve; residents can access the reserve via an unformed road (along the eastern side of the reserve) from Mount Hall Street and Adelaide Road. Alternatively access is possible along the boundary of the reserve, which is maintained by council. The reserve is highly degraded, of the 2.23ha there is approximately 1.1 hectares of remnant bushland in the reserve.

Ross Walbridge Reserve is located to the north of Adelaide Street and is 11.7 hectares in size. Flying Foxes began roosting at this site in November 2014 following the approved removal (Under section 95(2) of a number of known roosting trees along the southern and south-west boundary of Newbury Park (Pers. Comm. Port Stephens Council). The reserve is located 850m south-east of the Hunter River and approximately 700m east of Raymond Terrace Shopping district. The reserve continues to the south on the other side of Adelaide Street.

The Reserve provides a dense canopy cover of Swamp Oak Woodland and a reasonable area of open water. Species present include Swamp Mahogany (*Eucalyptus robusta*), Smooth-barked Apple (*Angophora costata*), both of which are considered to be important as Flying Fox foraging habitat.

The reserve is predominantly a passive and active recreational reserve, containing a number of picnic tables, barbeques and formal pathways. There is one sports field, located on the northern end of the reserve which holds regular sporting events on weekends. There are two separate lagoons, which cover 1.6 hectares. Flying foxes occupy the southern Lagoon when the colony is not at full capacity. Flying Foxes have been recorded at the second Lagoon when numbers exceeded 20,000 in 2016.

Both reserves are located north east of the Raymond Terrace Town Centre and industrial area. The surrounding areas are predominantly low density residential dwellings. Directly south of Newbury Park is the Muree Golf Course. Further to the south east of both reserves, there are widespread areas of contiguous bushland, which is a mix of council land, vacant Crown land and private land parcels. To the west is largely rural and most of the natural vegetation had been extensively cleared as a result of past agricultural practices.

2.2.3 Ecological role of Flying Foxes

Flying-foxes, along with some birds, make a unique contribution to ecosystem health through their ability to move seeds and pollen over long distances (Southerton et al. 2004). This contributes directly to the reproduction, regeneration and viability of forest ecosystems (DoE 2016a).

It is estimated that a single flying-fox can disperse up to 60,000 seeds in one night (ELW&P 2015). Some plants, particularly *Corymbia spp*., have adaptations suggesting they rely more heavily on nocturnal visitors such as bats for pollination than daytime pollinators (Southerton et al. 2004).

Grey-headed flying-foxes may travel 100 km in a single night with a foraging radius of up to 50 km from their camp (McConkey et al. 2012), and have been recorded travelling over 500 km in two days between camps (Roberts et al. 2012). In comparison bees, another important pollinator, move much shorter foraging distances of generally less than one kilometre (Zurbuchen et al. 2010).

Long-distance seed dispersal and pollination makes flying-foxes critical to the long-term persistence of many plant communities (Westcott et al. 2008; McConkey et al. 2012), including eucalypt forests, rainforests, woodlands and wetlands (Roberts et al. 2006). Seeds that are able to germinate away from their parent plant have a greater chance of growing into a mature plant (EHP 2012). Long-distance dispersal also allows genetic material to be spread between forest patches that would normally be geographically isolated (Parry-Jones & Augee 1992; Eby 1991; Roberts 2006). This genetic diversity allows species to adapt to environmental change and respond to disease pathogens. Transfer of genetic material between forest patches is particularly important in the context of contemporary fragmented landscapes.

Flying-foxes are considered ‘keystone’ species given their contribution to the health, longevity and diversity among and between vegetation communities. These ecological services ultimately protect the long-term health and biodiversity of Australia’s bushland and wetlands. In turn, native forests act as carbon sinks, provide habitat for other fauna and flora, stabilise river systems and catchments, add value to production of hardwood timber, honey and fruit (e.g. bananas and mangoes; Fujita 1991), and provide recreational and tourism opportunities worth millions of dollars each year (EHP 2012; ELW&P 2015).

2.2.4 Flying Fox Habitat

Vegetation Communities

The dominant vegetation community on site is Swamp Oak Forest/Rushland, the species present indicate that the vegetation community is associated with the Swamp oak Floodplain Forest (an Endangered Ecological Community)

A number of other vegetation communities were identified in the area and described in Figure 8.

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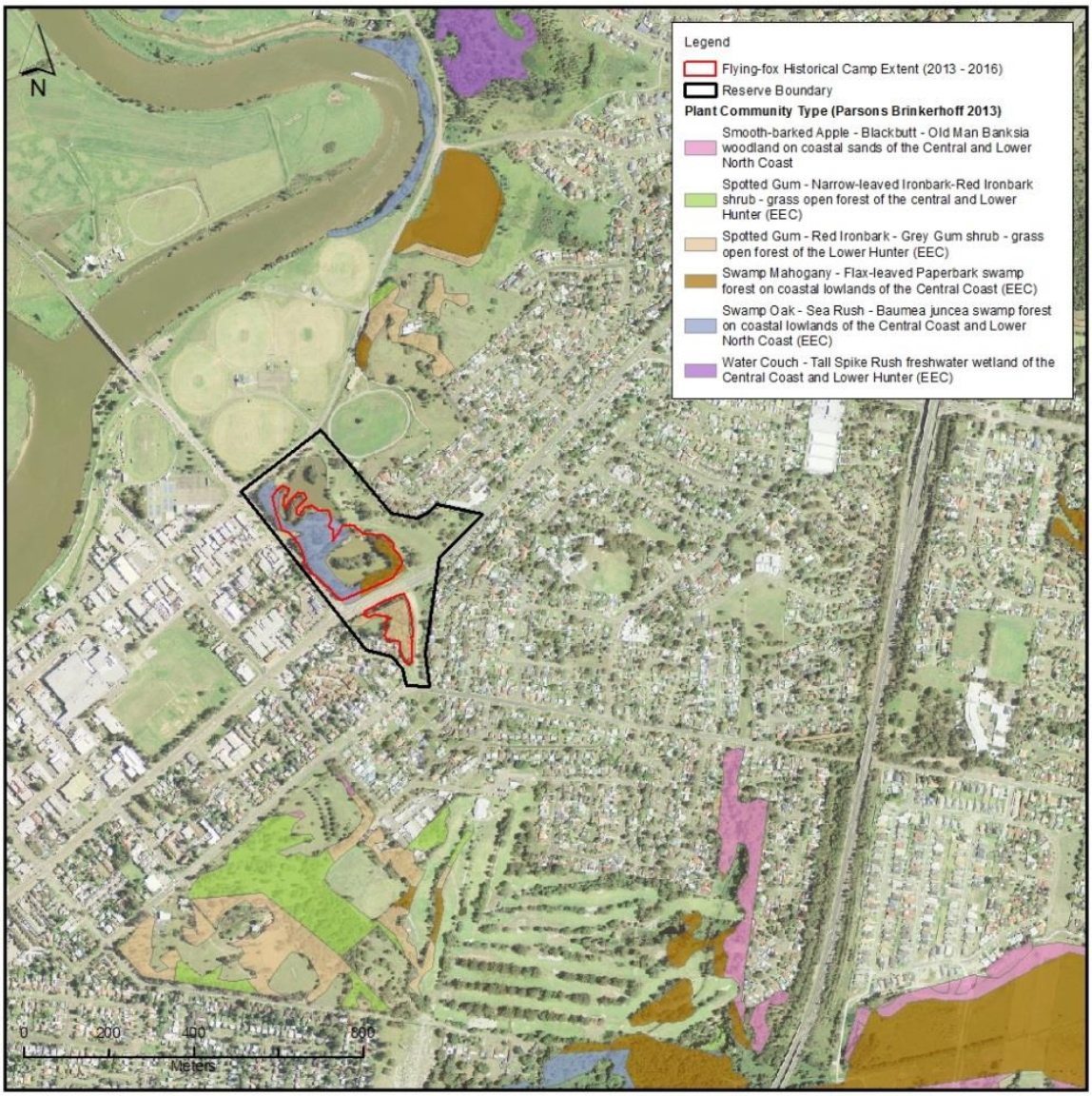
Figure 8: Vegetation types at the Raymond Terrace Flying-fox Camp and surrounds



Threatened Species & Endangered Ecological Communities

The Raymond Terrace Flying-fox Camp is located on Council land found to contain an Endangered Ecological Community “Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions”:

A list of threatened species, endangered populations and endangered ecological communities recorded within 10 km of the camp, which are likely to occur based on known habitat requirements is provided in Table 2.

Table 2: Threatened species and ecological communities that are likely to occur at the site[1]

Species Name	Common Name	NSW Status	Commonwealth Status
Fauna			
Botaurus poiciloptilus	Australasian Bittern	E1,P	E
Rostratula australis	Australian Painted Snipe	E1,P	E
Ephippiorhynchus asiaticus	Black-necked Stork	E1,P	
Oxyura australis	Blue-billed Duck	V,P	
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V,P	
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V,P	
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V,P	
Mormopterus norfolkensis	Eastern Freetail-bat	V,P	
Pandion cristatus	Eastern Osprey	V,P,3	
Stictonetta naevosa	Freckled Duck	V,P	
Calyptorhynchus lathami	Glossy Black-Cockatoo	V,P,2	
Scoteanax rueppellii	Greater Broad-nosed Bat	V,P	
Litoria aurea	Green and Golden Bell Frog	E1,P	V
Pteropus poliocephalus	Grey-headed Flying-fox	V,P	V
Phascolarctos cinereus	Koala	V,P	V
Chalinolobus dwyeri	Large-eared Pied Bat	V,P	V
Miniopterus australis	Little Bentwing-bat	V,P	
Hieraaetus morphnoides	Little Eagle	V,P	
Glossopsitta pusilla	Little Lorikeet	V,P	
Anseranas semipalmata	Magpie Goose	V,P	
Tyto novaehollandiae	Masked Owl	V,P,3	
Ninox strenua	Powerful Owl	V,P,3	
Anthochaera phrygia	Regent Honeyeater	E4A,P	CE
Myotis macropus	Southern Myotis	V,P	
Circus assimilis	Spotted Harrier	V,P	
Dasyurus maculatus	Spotted-tailed Quoll	V,P	E
Lophoictinia isura	Square-tailed Kite	V,P,3	
Petaurus norfolcensis	Squirrel Glider	V,P	
Ptilinopus superbus	Superb Fruit-Dove	V,P	
Lathamus discolor	Swift Parrot	E1,P,3	CE
Neophema pulchella	Turquoise Parrot	V,P,3	

[1] Source: Atlas of Living in Australia 08/11/2016

Species Name	Common Name	NSW Status	Commonwealth Status
Crinia tinnula	Wallum Froglet	V,P	
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V,P	
Flora			
Maundia triglochinoides		V,P	
Persicaria elatior	Tall Knotweed	V,P	V
Asperula asthenes	Trailing Woodruff	V,P	V
Endangered Ecological Community (EEC)			
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions		EEC	
Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions		EEC	

V- Vulnerable, P – Protected, E1 – Endangered Species, E2 – Endangered Population, E4A – Critically Endangered, CE – Critically Endangered.

Foraging Areas

Important foraging species of Red Ash and Silky Oak were recorded along the edge of the bushland extent of the two reserves. To the South of the Camp there is abundant and varied natural foraging habitat available for Flying Foxes, including Red Bloodwood (*Corymbia gummifera*), Broad-leaved Paperbarks (*Melaleuca quinquenervia*), Swamp Mahogany (*Eucalyptus robusta*), Smooth-barked, Apple (*Angophora costata*), Weeping Bottlebrush (*Callistemon salignus*) and Broad-leaved Paperbark (within 6km of the Camp). Appendix 2 details the results recorded from the rapid vegetation assessment, outlining the species present at the Raymond Terrace Camp. Within the residential zone surrounding the Camp, there is an abundance of planted foraging habitat, namely Cocos Palm and Silky Oaks.

The number of flying-foxes present in a camp is primarily driven by the amount and quality of food available in the local area, relative to that available within migration distance (Tidemann 1999; Eby 1991; Roberts et al 2012). Flying-foxes typically feed within 20 km of their roost (Tidemann 1999), and thus digital maps of feeding habitat for Grey-headed Flying-foxes have been used to summarise feeding resources within 20 km of the Raymond Terrace camp (Eby and Law 2008).

Approximately 51% of land within 20 km of the Raymond Terrace site supports native forests and woodlands in patches ranging in size from small remnants to extensive tracts in conservation reserves and state forests. Rainforest is rare and rainforest fruit provides insignificant food resources for flying-foxes during late summer and autumn. By contrast, approximately 85% of the forested land within 20km of Raymond Terrace contains flowering trees visited by the animals.

The vegetation surrounding Raymond Terrace is diverse and 17 species of trees in the flower diet of Grey-headed flying-foxes occur within feeding range of the camp (Table 3). They vary considerably in the amount of nectar they secrete, the frequency and duration of flowering, their seasonal flowering schedules and their area of distribution. Interactions between these characteristics determine the influence they have on the size of the population of flying-foxes roosting at the Raymond Terrace camp. Species with restricted distributions or that produce relatively low volumes of nectar are likely to have a minor influence on the number of flying-foxes feeding in the area, while widespread and highly productive species are likely to have a substantial influence (Table 3).

Significant flowering in 5 species is likely to attract flying-foxes to the site during summer and early autumn (Table 3). The size of the flying-fox population should fluctuate considerably during these months and peak in years when Red Bloodwood or Spotted Gum flowers heavily. Relatively large populations are likely to arrive in spring in years when Broad-leaved Ironbark or Grey Ironbark flower well. Native vegetation in the area is unlikely to support populations through the winter due to the highly-restricted distribution of diet plants that flower in those months. Nonetheless, it is possible for over-wintering populations to be supported by urban plantings, particularly in years of wide-spread

food scarcity in native forests. Early flowering of ironbarks and other species may attract flying-foxes in late winter.

Table 3: Grey-headed Flying-fox food trees

Characteristics of flowering trees in the diet of Grey-headed Flying-foxes that occur within 20 km of the Raymond Terrace camp. Nectar abundance is scored in 4 categories from 0 to 1; the approximate frequency of flowering is also scored in 4 categories relating to % of years; duration of flowering is scored in months. Species likely to play a significant role in determining the number of flying-foxes present in the camp, as assessed by nectar abundance and area of distribution, are highlighted in grey. Species found in <1% of native vegetation have been excluded. See Eby and Law (2008) for further details.

Species	Common Name	% Area of Native Vegetation	Flowering Characteristics			Bi-monthly Flowering Schedule					
			Nectar Abundance	Frequency (% yrs)	Duration (mth)	Dec-Jan	Feb-Mar	Apr-May	Jun-Jul	Aug-Sep	Oct-Nov
Corymbia gumifera	Red Bloodwood	35%	1.0	0.4	2	X	X				
C. maculata	Spotted Gum	30%	1.0	0.25	4-6		X	X	X		
Eucalyptus fibrosa	Broad-leaved Ironbark	20%	0.7	0.4	2	X					X
E. pilularis	Blackbutt	15%	1.0	0.4	2	X	X				
E. siderophloia	Grey Ironbark	10%	1.0	0.7	2	X					X
Angaphora costata	Smooth-barked Apple	35%	0.3	0.4	1						X
E. acmenoides	White Mahogany	5%	0.3	0.7	1	X					X
E. parramattensis	Parramatta Red Gum	1%	0.5	0.4	2	X					X
E. piperita	Sydney Peppermint	1%	0.5	0.4	1	X					
E. propinqua	Small-fruited Grey Gum	3%	0.5	0.4	2	X	X				
E. punctata	Large-fruited Grey Gum	25%	0.3	0.7	1	X	X				
E. resinifera	Red Mahogany	1%	0.5	0.4	2	X	X				
E. robusta	Swamp Mahogany	5%	1.0	1.0	3			X	X		
E. saligna	Sydney Blue Gum	2%	0.7	0.7	1	X	X				
E. tereticornis	Forest Red Gum	1%	1.0	1.0	2					X	X
Melaleuca quinquenervia	Broad-leaved Tea Tree	5%	1.0	1.0	3-4		X	X			
Syncarpia glomifera	Turpentine	3%	0.5	0.7	2					X	X
						11	**8**	**3**	**1**	**2**	**6**

Roosting Areas

Roosting habitat was identified in the core of the reserve and along the eastern side of the Newbury Park, specifically in Silky Oak (*Grevillea robusta*), Willows (*Salix spp*.) and Swamp-Oak (*Casuarina glauca*). There is limited planted roosting habitat in nearby residential properties.

Potential Overflow Roosting Areas

A number of potential roosting habitat species (native and exotic) have been identified and are discussed in Table 4, and Figure 9. If the camp was to reach capacity the flying-foxes are likely to look for the nearest potential roosting availability.

Muree Golf course, Boomerang Park and the cemetery are the closest likely places the flying-foxes may choose due to some clusters and rows of large trees with dense lower to upper canopies. In Boomerang Park there is also a swampy depression and a pond which has vegetation around it. Besides these areas, there may be certain small groups or rows of trees amongst residential properties and business areas near the camp which flying-foxes may look at using.

It will be important to maintain and potentially increase roosting habitat on either side of the core camp area, to provide adequate habitat for the camp to expand in peak periods. This may reduce the likelihood of overflow into residential and business areas of the town.

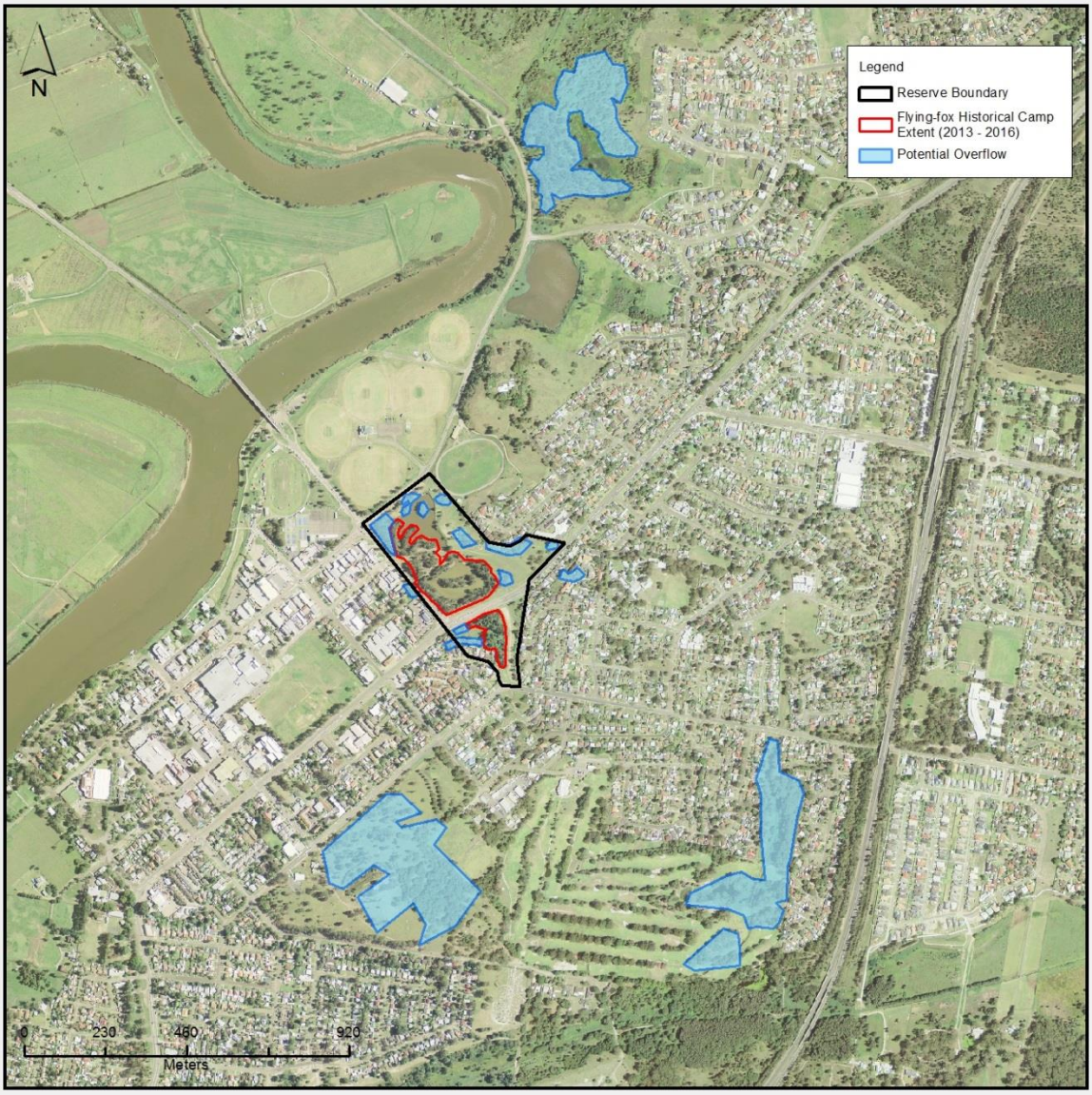
Table 4: Description of Potential Roosting Overflow Locations

Site Number	Species	Roosting/foraging habitat and condition	Roosting/foraging habitat/impact on residential areas and schools
Adjacent to the Camp			
820/Zone 5	*Casuarina glauca*	She-Oak	Roosting habitat
820/Zone 5	*Melaleuca stypheloides*	Prickly Tea Tree	Roosting habitat
822/Zone 5	*Alphitona excelsa*	Red Ash	Potential Foraging habitat
822/Zone 5	*Glochidion ferdinandii*	Cheese Tree	Potential Foraging habitat
823/Zone 4	Salix spp.	Willow Tree	Roosting habitat
824/Zone 5	*Erythrina crista-galli*	Cockspur Coral Tree	Potential Foraging habitat
825/Zone 5	*Grevillea robusta*	Silky Oak	Potential Foraging habitat
826/ Zone 1		Liquid Ambar	Roosting habitat
827/Zone 1	*Cinnamomum camphora*	Camphor laurel	Roosting habitat
827/Zone 1	Salix spp.	Willow Tree	Roosting habitat
827/Zone 1		Banana	Potential Foraging habitat
827/Zone 1		Wild Tobacco	Potential Foraging habitat
Within 6km of the Camp			
1. Grahamstown Drain	Swamp-oak Rushland	Swamp Oak, Prickly-leaved Tea Tree, Flax-leaved Paperbark	Potential Foraging habitat 2.2km south east of the Camp on a drainage line
2. Golf Course	Swamp-oak Rushland	Swamp Oak, Prickly-leaved Tea Tree, Flax-leaved Paperbark	Potential Foraging habitat 0.9km south east of the Camp on a drainage line

Site Number	Species	Roosting/foraging habitat and condition	Roosting/foraging habitat/impact on residential areas and schools
3. Windeyers Creek, Adelaide Road	Swamp-oak Rushland	Swamp Oak, Prickly-leaved Tea Tree, Flax-leaved Paperbark	Potential Foraging habitat 2.2km south west of the Camp on a drainage line
4. Windeyers Creek near Hunter River	Swamp-oak Rushland	Swamp Oak, Prickly-leaved Tea Tree, Flax-leaved Paperbark	Potential Foraging habitat 2.9km west of the Camp on a drainage line

Zones as identified in the Vegetation Management Plan, Newbury Flying Fox Camp, Raymond Terrace

Figure 9: Potential overflow habitat surrounding the Raymond Terrace Flying-fox Camp



Potential Alternative Roosting Areas

There are some potential alternative roost sites within 10km of the Camp:

- The Hunter and Williams River have been heavily cleared right up to the river in this area so there is very limited roosting potential available near this camp. An area was identified approximately 1km to the north of the Camp which may be a suitable location to attempt restoration of the river bank to create a potential overflow site or to encourage roosting away from residential areas. The section of river bank is on the western side of newline road running north from an oval for approximately 500 meters. Potentially both sides of Newline road at this location could be looked at restoring to create roosting habitat.
- The closest known roost site to this camp containing grey-headed flying-foxes is on the east side of Medowie, in Moffat's swamp, approximately 11kms to the east. This camp has been occupied on an irregular basis from general observations made over the years however due to the extent of the swamp it may be possible that on occasion the flying-foxes may have been overlooked. The fly out timing and direction can be a good indicator to use to see if flying-foxes are using the Moffat's swamp camp.

2.2.5 Flying-foxes in Urban Areas

Flying-foxes appear to be roosting and foraging in urban areas more frequently. There are many possible drivers for this, as summarised by Tait et al. (2014):

- loss of native habitat and urban expansion;
- opportunities presented by year-round food availability from native and exotic species found in expanding urban areas;
- disturbance events such as drought, fires and cyclones;
- human disturbance or culling at non-urban roosts or orchards;
- urban effects on local climate;
- refuge from predation;
- movement advantages, e.g. ease of maneuvering in flight due to the open nature of the habitat or ease of navigation due to landmarks and lighting.

In and around the Raymond Terrace Flying-fox Camp the following threats and hazards have been noted:

- Natural food shortages – due to land clearing in combination with poor flowering seasons;
- Fruit tree netting – females with young have been observed trapped in netting (2017);
- Heat events – recent heat waves have seen animal deaths throughout the region;
- Disturbance from local residents – numerous attempts to set fire to the camp occurred in 2016;
- Fireworks – Wildlife Rehabilitators often get calls to attend injured animals after fireworks have been set off;
- Plane strike – from Newcastle airport, based in Williamtown (this is a low risk).

2.2.6 Flying-foxes Under Threat

Flying-foxes roosting and foraging in urban areas more frequently can give the impression that their populations are increasing; however, the grey-headed flying-fox is in decline across its range and in 2001 was listed as vulnerable by the NSW Government through the Threatened Species Conservation Act 1995.

At the time of listing, the species was considered eligible for listing as vulnerable as counts of flying-foxes over the previous decade suggested that the national population may have declined by up to 30%. It was also estimated that the population would continue to decrease by at least 20% in the next three generations given the continuation of the current rate of habitat loss and culling.

The main threat to grey-headed flying-foxes in NSW is clearing or modification of native vegetation. This threatening process removes appropriate roosting and breeding sites and limits the availability of natural food resources, particularly winter–spring feeding habitat in north-eastern NSW. The urbanisation of the coastal plains of south-eastern Queensland and northern NSW has seen the removal of annually-reliable winter feeding sites, and this threatening process continues.

There is a wide range of ongoing threats to the survival of the Grey Headed Flying-fox, including:

- habitat loss and degradation;
- conflict with humans (including culling at orchards);
- infrastructure related mortality (e.g. entanglement in barbed wire fencing and fruit netting, power line electrocution, etc.);
- predation by native and introduced animals;
- exposure to extreme natural events such as cyclones, drought and heat waves.

Flying-foxes have limited capacity to respond to these threats and recover from large population losses due to their slow sexual maturation, small litter size, long gestation and extended maternal dependence (McIlwee & Martin 2002).

2.2.7 Flying-foxes and Heat Stress

Heat stress affects flying-foxes when temperatures reach 42°C or more. Over the past two decades, a number of documented heat stress events have resulted in significant flying-fox mortality.

While there is conflicting advice about how or whether to intervene during a heat stress event at a flying-fox camp, it should be noted that human presence in a camp at such times can increase the stress and activity levels of flying-foxes present, potentially leading to greater harm. Any response to a heat stress event should be undertaken as an organised and monitored response. It is recommended that data is collected after the heat stress event and provided to scientists able to analyse the data and to help the Office of Environment and Heritage share best practice management techniques as they are developed. The data collected will help improve future advice on intervention during these events.

When ambient temperatures rise above 35°C flying-foxes tend to alter their behaviour to reduce exposure to heat. A range of behaviours may be exhibited, depending on multiple variables in their environment. The impacts of heat stress events are likely to vary site by site, and can depend on conditions in the preceding days. Ambient temperature alone may thus not be a sound indicator of a heat stress event, and flying-fox behaviour may provide more reliable information. As flying-foxes experience heat stress, they are likely to exhibit a series of behaviours indicating progressive impact of that stress, including:

- clustering or clumping,
- panting,
- licking wrists and wing membranes,
- descending to lower levels of vegetation or to the ground.

Some of these behaviours may occur outside of heat stress events.

Black Flying-foxes tend to start dying above ~42°C, and Grey-headed Flying-foxes above ~43°C

December 2017 and January 2018 saw temperatures exceed 42°C on consecutive days in Raymond Terrace resulting in over 1,000 deaths.

2.2.8 Human and Animal Health

Flying-foxes, like all animals, carry bacteria and other microorganisms in their guts, some of which are potentially pathogenic to other species. Direct contact with faecal material should be avoided and general hygiene measures taken to reduce the low risk of gastrointestinal and other disease.

Contamination of water supplies by any animal excreta (birds, amphibians and mammals such as flying-foxes) poses a health risk to humans. Household tanks should be designed to minimise potential contamination, such as using first flush diverters to divert contaminants before they enter water tanks. Trimming vegetation overhanging the catchment area (e.g. the roof of a house) will also reduce wildlife activity and associated potential contamination. Tanks should also be appropriately maintained and flushed, and catchment areas regularly cleaned to remove potential contaminants.

Public water supplies are regularly monitored for harmful microorganisms, and are filtered and disinfected before being distributed. Management plans for community supplies should consider whether any large congregation of animals, including flying-foxes, occurs near the supply or catchment area. Where they do occur, increased frequency of monitoring should be considered to ensure early detection and management of contaminants.

Flying-foxes, like all animals, carry pathogens that may pose human health risks. Many of these are viruses which cause only asymptomatic infections in flying-foxes themselves but may cause significant disease in other animals that are exposed. In Australia the most well-defined of these include Australian bat lyssavirus (ABLV), Hendra virus (HeV) and Menangle virus. Specific information on these viruses is provided in Appendix 3.

Outside of an occupational cohort, including Wildlife Rehabilitators and vets, human exposure to these viruses is extremely rare and similarly transmission rates and incidence of human infection are very low. In addition, HeV infection in humans requires transfer from an infected intermediate equine host and direct transmission from bats to humans has not been reported. Thus despite the fact that human infection with these agents can be fatal, the probability of infection is extremely low and the overall public health risk is judged to be low (Qld Health 2016).

2.3 Legislative and Regulatory Context

The Grey-Headed Flying-fox (*Pteropus poliocephalus*) is listed as a vulnerable species under the Federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and is therefore considered a 'Matter of National Environmental Significance' and is therefore protected under federal law.

The Raymond Terrace Flying-fox Camp is further protected under the EPBC Act as it is considered a Nationally Important Camp as it meets the following criteria:

- contained ≥10,000 GHFF in more than one year in the last 10 years, or
- been occupied by more than 2500 GHFF permanently or seasonally every year for the last 10 years.

The designation of the Camp as Nationally Important requires land managers to ensure all management activities meet the following standards:

- The action must not occur if the camp contains females that are in the late stages of pregnancy or have dependent young that cannot fly on their own.
- The action must not occur during or immediately after climatic extremes (heat stress event[2], cyclone event[3]), or during a period of significant food stress[4].

[2] A 'heat stress event' is defined for the purposes of the Australian Government's Referral guideline for management actions in GHFF and SFF camps as a day on which the maximum temperature does (or is predicted to) meet or exceed 38°C.

[3] A 'cyclone event' is defined as a cyclone that is identified by the Australian Bureau of Meteorology (www.bom.gov.au/cyclone/index.shtml).

[4] Food stress events may be apparent if large numbers of low body weight animals are being reported by wildlife carers in the region.

- Disturbance must be carried out using non-lethal means, such as acoustic, visual and/or physical disturbance or use of smoke.
- Disturbance activities must be limited to a maximum of 2.5 hours in any 12 hour period, preferably at or before sunrise or at sunset.
- Trees are not felled, lopped or have large branches removed when flying-foxes are in or near to a tree and likely to be harmed.
- The action must be supervised by a person with knowledge and experience relevant to the management of flying-foxes and their habitat, who can identify dependent young and is aware of climatic extremes and food stress events. This person must make an assessment of the relevant conditions and advise the proponent whether the activity can go ahead consistent with these standards.
- The action must not involve the clearing of all vegetation supporting a nationally-important flying-fox camp. Sufficient vegetation must be retained to support the maximum number of flying-foxes ever recorded in the camp of interest.

These standards have been incorporated into mitigation measures detailed in Appendix 8. If actions cannot comply with these mitigation measures, an EPBC Act referral for activities at nationally important camps is likely to be required.

In NSW, the grey-headed flying-fox was listed as vulnerable under the (then) *Threatened Species Conservation Act 1995* in 2001 (now the Biodiversity Conservation Act). This listing is based on scientific evidence indicating a significant decline in the population of the species and that it is "likely to become endangered unless the circumstances and factors threatening its survival or evolutionary development cease to operate" (NSW Scientific Committee 2001).

This means that if present processes continue the species could become extinct. A draft national recovery plan has also been prepared for the species (DECCW 2009, Geolink 2013). Provisions in the Biodiversity Conservation Act (replacing the *Threatened Species Conservation Act 1995)*, *National Parks and Wildlife Act 1974* (now amended and largely incorporated into the Biodiversity Conservation Act) and *Environmental Planning and Assessment Act 1979* mean that actions likely to adversely affect the species generally require approval or licensing, and that impacts on the species require assessment.

The NSW Office of Environment and Heritage (OEH) has prepared the 'Flying-fox Camp Management Policy' 2015, intended to empower land managers, primarily local councils, to work with their communities to manage flying-fox camps effectively. It provides the framework within which OEH will make regulatory decisions. The Policy encourages local councils and other land managers to prepare camp management plans for sites where the local community is affected.

Additionally, any activities undertaken on NSW Government property will also need to comply with relevant Environmental Planning Instruments including approvals under Part 4 or 5 of the EP&A Act. A summary of the key legislation that applies to this plan is detailed in Appendix 4.

Parliamentary Inquiry into flying-fox management in the eastern states

In 2016-17 the House of Representatives Standing Committee on the Environment and Energy undertook an inquiry into the increasing tensions being experienced by residents affected by flying-fox camps.

In order to gather evidence from the relevant stakeholders and experts within the agreed timeframe, the Committee conducted a roundtable public hearing in Canberra (February 2017). This enabled productive engagement with a wide range of experts and representatives of affected communities. The Committee also received a range of written submissions and correspondence outlining stakeholder experiences and community concerns about local flying-fox issues.

The Committee agreed that Flying-foxes act as important pollen and seed dispersers for a wide range of native vegetation across the east coast of Australia. Due to their ecological importance in maintaining some of Australia's most significant ecosystems, work needs to be undertaken to ensure the preservation of flying-fox species across the country.

The Committee further noted the reduction in suitable foraging and roosting habitat, among other factors, has impacted on the population size of several species, leading the Spectacled Flying-fox and Grey-headed Flying-fox to be listed as 'Vulnerable' under the Environment Protection and Biodiversity Conservation Act 1999. The expansion of human populations across coastal New South Wales and Queensland has led to flying-fox camps becoming increasingly located in urban and rural residential areas, possibly from movements of camps due to loss of natural habitat, or the expansion of human settlement into traditional flying-fox habitats.

In the Parliamentary paper 37/2017 the Committee produced a number of recommendations that have been forwarded to the Commonwealth Department of Environment & Energy for consideration and action:

1. The development of a national or eastern states flying-fox consultative committee or working group to the Council of Australian Governments which would be responsible for centrally compiling information on referrals and management actions, and identifying priorities for legislative harmonisation, research and funding.
2. Establishment of dedicated funding pool for flying-fox research and conservation actions
3. The development of a tool that assists councils to make decisions on action, referral and education in the most appropriate way, relevant to the flying-fox impacts in their jurisdiction
4. The development of a suite of education resources for Australian communities regarding flying-fox ecology, behaviour, environmental significance, health impacts, and management options.

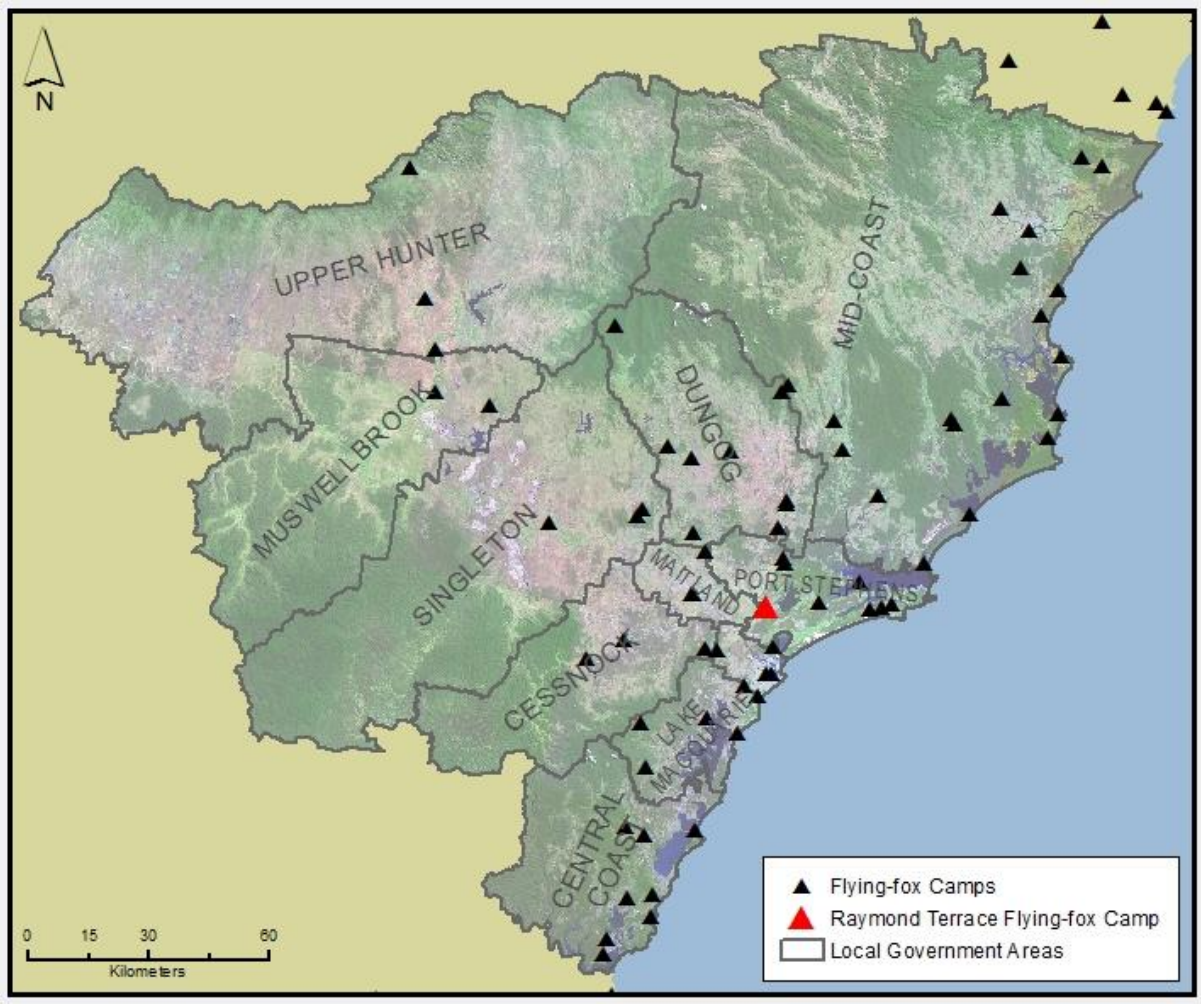
According to the Parliament of Australia website (accessed July 2018) no response has been received to date on the completed Parliamentary Paper 37/2017.

2.4 Regional Context

The Hunter & Central Coast Region is home to 58 known Flying-fox Camps (see Figure 10), 53 of which have observed Flying-foxes roosting in them since 2012. It is highly likely that there are additional Camps throughout the vegetated areas (private land and National Parks / State Forest) of the region that are well away from human settlements and are currently unaccounted in the CSIRO National Flying-fox Camp Census.

The 2013 "*Grey-headed Flying-fox Management Strategy for the Lower Hunter*" developed by GEOlink stated that in the lower Hunter there were 6 Camps considered critical to Flying-fox survival in the Lower Hunter (these being: Millfield, Martinsville, Morisset, Blackbutt Reserve, Anna Bay, Medowie and Tocal). None of these Critical sites are managed via a Camp Management Plan and are currently not subject to conflict with Human settlements.

Figure 10: Known Flying-fox Camps throughout the Hunter & Central Coast region



The 2013 Strategy also stated that a further six Camps (Black Hill, Belmont, Glenrock, Hannan Street, Italia Road and Raymond Terrace) were not critical to survival in the Lower Hunter, and reflecting on changes in Flying-fox roosting patterns in the past 4 years we now know that Black Hill and Hannan Street are no longer utilised as Camps, and the Raymond Terrace Camp is now listed as a Nationally Significant site given the number of Flying-foxes now utilising the site for roosting and mating / maternity activities.

During 2012-2018 flying-fox roosting patterns have been changing rapidly throughout the region, with a number of previously important Camps being abandoned, and small Camps becoming much more significant for roosting and breeding of Flying-foxes. The development of local Camp Management Plans and Regional Strategies will assist Councils to address community concerns and work to reduce the possibility of new areas of conflict arising with increased growth of the Hunter Region.

Ongoing research into Flying-fox behaviours appears to indicate that food shortages precede the abandonment of traditional camps, and the creation of new camps, and many more. Following the 2010 Flying-fox food shortage the number of Camps in Sydney increased from 7 to 22. Occupancy of these new camps did not appear to reduce when food supply increased, suggesting that once roosting and feeding patterns change, the roosting behaviour has been adapted and in most cases does not revert back to previous behaviours. This has also been played out in the Hunter region.

Overall the location and scale of Flying-fox Camps in NSW has changed significantly since 2002, when Camps were mostly found in the North of the State, in 2015 following both food shortages, and preferred food flowering events, the Flying-fox populations have spread both South and west, with a number of new camps being created inland, and on the NSW South Coast. Since 2015, the majority of new Camps created have been in vegetated areas quite close to human populations.

Regional Flying-fox Foraging Preferences

Work is currently being undertaken by the Hunter Joint Organisation of Councils, to identify key flying-fox foraging areas throughout the Region to progress work conducted in 2013. The incorporation of this information into Councils land use plans (and equivalent planning documents) will assist Council to, where possible, preserve areas of high value Flying-fox foraging vegetation, and potentially protect areas suitable for Flying-fox roosting that may have reduced conflict issues (i.e. not be located in close proximity to human settlements). Although Flying-foxes are wild animals and it is not possible to predict where they will choose to roost, if there are no alternatives to the current conflict Camp sites, it can be guaranteed the animals will not move on of their own accord.

Updated foraging models (from those created for the 2013 Management Strategy) will be included in the Hunter & Central Coast Regional Flying-fox Management Strategy and will therefore supersede the information provided below (based on changes to vegetation cover and density), but it is expected that the basis of the information included in Table 5 and Table 6, will remain valid.

Flying-foxes have a preference for different native plants for food foraging; diet plants in the region are productive in each bi-month, although species richness varies through the year as shown in Table 5. Broad seasonal patterns in the number of productive species are in keeping with other regional areas (Eby & Law 2008). The greatest proportion of dietary species flower in Dec /Jan (14 spp, 52%) and species richness reaches low levels from late autumn to early spring (4 spp, 15%).

Table 5: Bi-monthly flowering phenologies of GHFF diet plants found in the Lower Hunter region (source: Geolink 2013)

Species	Dec-Jan	Feb-Mar	Apr-May	Jun-Jul	Aug-Sep	Oct-Nov
Angophora costata						X
A. floribunda	X					
Banksia integrifolia			X	X	X	
Corymbia eximia						X
C. gummifera		X				
C. maculata		X	X	X		
Eucalyptus acmenoides	X					X
E. albens				X	X	
E. amplifolia						X
E. botryoides	X					
E. camaldulensis	X					
E. deanii	X	X				
E. fibrosa	X					X
E. longifolia			X			
E. moluccana		X				
E. paniculata	X					X
E. parramattensis	X					
E. pilularis	X	X				
E. piperita	X					
E. punctata	X	X				
E. resinifera	X	X				
E. robusta			X	X		
E. saligna	X	X				
E. siderophloia	X					X
E. tereticornis					X	X
M. quinquenervia		X	X			
S. glomulifera					X	X

Based on the information included in Table 5, there are only 6 species of tree that flower in winter that are preferential food sources for Flying-foxes, as such these species should be subject to protection to assist with Flying-fox survival in the region.

Additionally, a large number of fruit trees are preferred feed trees for Flying-foxes, with 38 species of rainforest trees and lianas in the fruit diet of Grey Headed Flying-foxes fall within the Lower Hunter region (see Table 6). The regional list comprises members of 27 families and 31 genera. Four genera are represented by more than one species. The most species rich genus is Ficus (6 spp.).

Table 6: Fruits in the diet of GHFF that occur in the Lower Hunter region (source: Geolink 2013)

Family Name	Species Name	Common Name
GYMNOSPERMAE		
Podocarpaceae	*Podocarpus elatus*	Plum Pine
ANGIOSPERMAE		
Apocynaceae	*Melodinus australis*	Southern Melodinus
Arecaceae	*Archontophoenix cunninghamiana*	Bangalow Palm
	Livistona australis	Cabbage Palm
Avicenniaceae	*Avicennia marina*	Grey Mangrove
Caprifoliaceae	*Sambucus australasica*	Yellow Elderberry
Chenopodiaceae	*Rhagodia candolleana*	Seaberry Saltbush
Cunoniaceae	*Schizomeria ovata*	Crabapple
Ebenaceae	*Diospyros pentamera*	Myrtle Ebony
Ehretiaceae	*Ehretia acuminata*	Koda
Elaeocarpaceae	*Elaeocarpus obovatus*	Hard Quandong
	E. reticulatus	Blueberry Ash
Escalloniacae	*Polyosma cunninghamii*	Featherwood
Icacinaceae	*Pennantia cunninghamii*	Brown Beech
Meliaceae	*Melia azedarach*	White Cedar
Monimiaceae	*Hedycarya angustifolia*	Native Mulberry
Moraceae	*Ficus coronata*	Creek Sandpaper Fig
	F. fraseri	Sandpaper Fig
	F. macrophylla	Moreton Bay Fig
	F. obliqua	Small-leaved Fig
	F. rubiginosa	Rusty Fig

Based on the foraging modelling the Lower Hunter is likely to experience significant food shortages during the winter months each year and is the likely cause of lower occupancy over winter. Significant flowering events are most likely from January to April and represent the highest likelihood of flying foxes returning to the Lower Hunter and increased camp occupancy and short term population in the camp.

Management Actions at other Flying-fox Camps

As mentioned, there are 58 known Flying-fox Camps across the region, with occupation of the camps varying each season and across each year. Approximately 7 councils in the region have recently developed or are developing Flying-fox Camp Management Plans, to address Flying-fox / Human conflict issues.

The management of Flying-foxes across councils is a prime issue at present, with councils in the region participating in the development of a Regional Flying-fox Strategy (project being led by the NSW Office of Environment & Heritage), party to regional Flying-fox education projects, and participants in a National Australian Research Council Grant project seeking to "link" existing Flying-fox research and solidify knowledge about the species, its value to Australian ecology and how the species can best be supported.

All councils in the Hunter & Central Coast have progressed management plans on the basis that Flying-fox management activities will not include Level 3 actions (dispersal or culling). There is an active understanding amongst council staff and senior managers that any move to disperse Flying-foxes from one Camp will undoubtedly place stress on other Camps in the region, or more likely (based on research on previous dispersal activities) create a splinter Camp nearby and ultimately cause a new residential area to be in conflict with the Flying-foxes.

The region, Local Councils, the Office of Environment & Heritage, Hunter Local Land Services, NSW Department of Industry – Lands and wildlife rehabilitators have all been actively working together to develop regionally consistent community engagement and education products in the hope that this can assist residents to understand why the Flying-foxes are in the region, how long they will stay on their migration, and ways that people can manage their property and level of interaction with them. The engagement project attempts to address previous negative media stories related to Flying-foxes.

3 Community Engagement

Port Stephens Council undertook a community engagement process to develop this Camp Management Plan.

3.1 Stakeholders / Interest Groups

There are a range of stakeholders who are directly or indirectly affected by the flying-fox camp, or who are interested in its management. Stakeholders include those shown in Table 7.

Table 7: Stakeholders in the camp and Plan

Stakeholders / Interest Groups	Interest / Reported Impacts
All community members	Affected by location of Camp and roosting and foraging of animals.
Residents living in the Raymond Terrace area directly impacted by the camp	Directly affected by roosting animals
Business owners	Affected by location of Camp and roosting and foraging of animals.
Civic leaders and influencers (including local, state and federal politicians)	Civic leaders need to be responsive to community concerns and manage legislative risk through Councils management activities.
Indigenous community	Significance of flying-foxes in local indigenous heritage
Schools	Potentially affected by location of Camp and roosting and foraging of animals
Hospitals / medical practices / Dept. of Health	Interested in human health issues related to flying-fox / human contact.
Equine facilities and vets	Equine facility managers and local vets should be aware of Hendra virus risk and appropriate mitigation measures. Where feasible, all horse owners within 20 km of the camp should be included in such communications.
Orchardists and fruit growers	Fruit growers may be impacted by flying-foxes raiding orchards.
Airports	Airport managers have a responsibility to reduce the risk of wildlife–aircraft strike.
Wildlife rehabilitators and conservation organisations Wildlife rehabilitators and conservation organisations have an interest in flying-fox welfare and conservation of flying-foxes and their habitat.	Bat Support Group - aims to work peacefully and positively with the community, land managers and government bodies to enable bats to live and thrive in the region. Provides support to bats through: Promotion, Protection, Information, Nurture and Conservation activities. LandCare groups – involved in habitat rehabilitation Bird Observer Groups – provide data on flowering gum events – indicates possible arrival of flying-foxes Landholders interested in wildlife conservation and habitat creation/ rehabilitation Hunter Wildlife
Researchers/CSIRO Researchers have an interest in flying-fox behaviour, biology and conservation.	CSIRO – manages national flying-fox monitoring program
Media • Port Stephens Examiner • Newcastle Herald • ABC Local Radio • 2NUR • Port Stephens FM	Work proactively with local media to deliver timely and correct information to the Raymond Terrace community.

Stakeholders / Interest Groups	Interest / Reported Impacts
Local government	Local government has responsibilities to the community and environment of the area for which it is responsible in accordance with the Local Government Act 1993. Council is also responsible for administering local laws, plans and policies, and appropriately managing assets (including land) for which it is responsible.
Local Government NSW (LGNSW) LGNSW is an industry association that represents the interests of councils in NSW.	The Flying-Foxes Grants Program has been established to help councils manage flying-fox camps in their areas, consistent with the Flying-Fox Camp Management Policy 2015.

3.2 Engagement Methods

Effort has been made to engage with the community regarding the flying-fox camp to:

- understand the issues directly and indirectly affecting the community
- raise awareness within the community about flying-foxes
- correct misinformation and allay fears
- share information and invite feedback about management actions and responses to date
- seek ideas and feedback about possible future management options

The types of engagement undertaken included:

- promotion of contact details of responsible officers
- website pages and links
- telephone conversations (record issues and complaints)
- direct contact with adjacent residents including letters, brochures, fact sheets and drop in listening posts
- community forums
- online survey (Flying-fox Engage)
- media releases and associated media
- brochures and other educational material including distribution of camp relevant as well as other stakeholder information (OEH developed materials / NSW Health Fact Sheets)

Specific media coverage is outlined in Appendix 5 and engagement activities are detailed in Table 8.

Table 8: Details of Community Engagement Activities undertaken in the development of the Raymond Terrace Camp Management Plan

Date	Consultation Activity
21/2/17	Councilors briefing
22/2/17	Community reference group briefing
28/2/17	MP briefing
March	Flying-fox Engage open
2/3/17	Direct mail out to residents in vicinity of camp regarding Flying-fox Engage
6/3/17	Media release – *Flying-fox management a joint effort*
March	Media Facebook posts and boosts - numerous Twitter posts - numerous Radio - 7/3 2HD 8:30 news - 6/3/17 ABC Newcastle 3pm news - 6/3/17 ABC Newcastle 5pm news Print/online media – - 3/3 Port Stephens Examiner- *Port Stephens Council consults Raymond Terrace residents over grey-headed flying fox plan* - 7/3/17 www.whatsoninourbackyard.com.au - *Flying-fox management a joint effort*
15/3/17	Listening Post – Alton Close
17/3/17	Listening Post – Centro Shopping centre 9-11am and 3-5pm
31/3/17	Flying-fox engage closes
4/4/17	Community Notice Port Stephens Examiner - *Update from the GM: Bats key to preservation of Port Stephens environment*
6/4/17	PS News item (internal)

Flying Fox Engage

The use of the Flying Fox Engage online survey was the key engagement tool to enable Council to receive direct feedback from the community on their experiences living near Flying-foxes and the values they place on them to provide some insight to Council on the management actions they would find acceptable to be employed on site.

To assist Council to understand where different responses were coming from (i.e. determine if concerns of residents closer to the Camp are different from those further away) the following were established see

Figure 11: Flying Fox Engage zones to map responses.

Details of the analysis of responses are provided in Section 3.3.

Figure 11: Flying Fox Engage zones to map responses

3.3 Community Feedback on Management Options

The main community feedback related to the development of the Camp Management Plan was received through the Flying fox engage system.

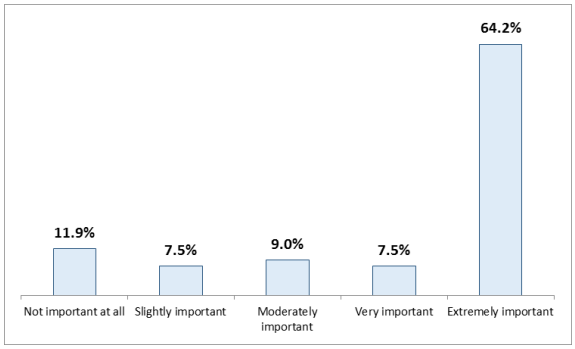
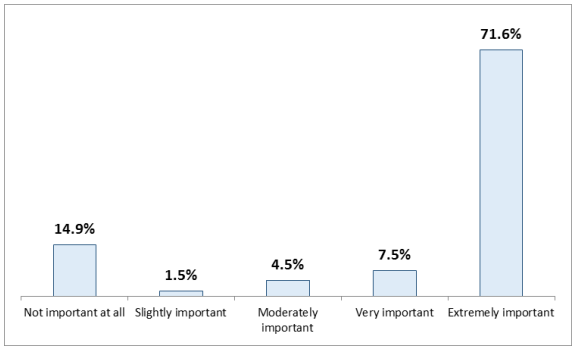
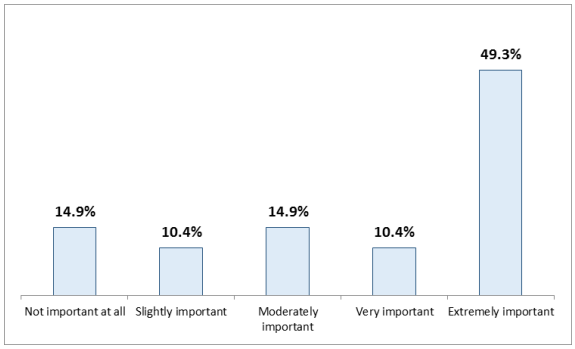
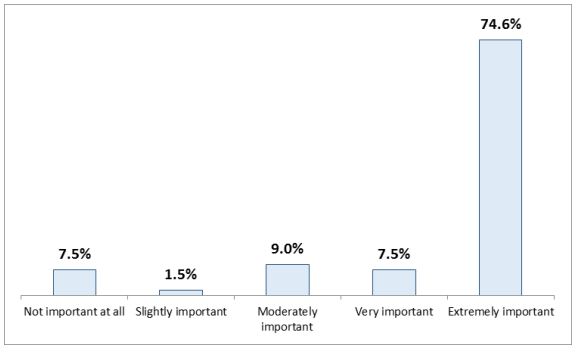
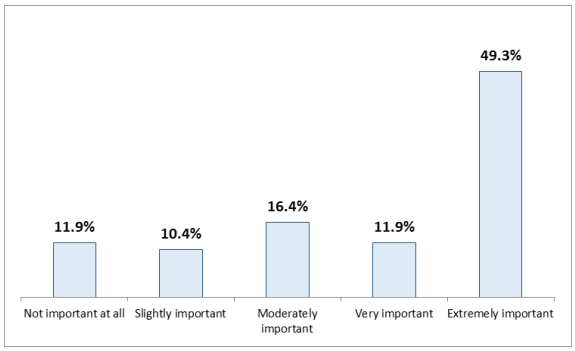
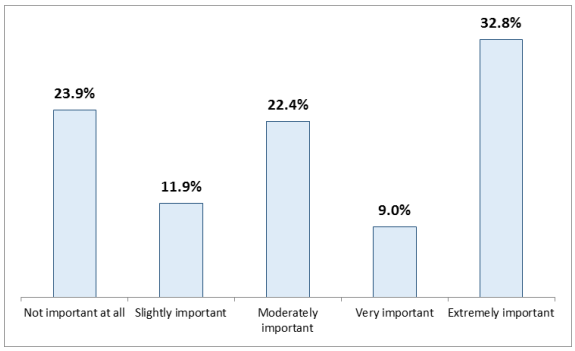
Flying fox engage is an innovative engagement decision support system. The online Flying fox engage consultation tool was launched in March 2017 with the website www.flyingfoxengage.com/portstephens remaining open for submissions until May 2017.

During this consultation period the Flying fox engage website received 67 valid submissions.

Flying fox engage is a relatively simple survey methodology that poses 12 questions to users, the responses to these questions then produces a ranked list of preferred management options that reflect the values of the survey respondent. The list is then able to be manipulated by the user to manually reorder the preferred list.

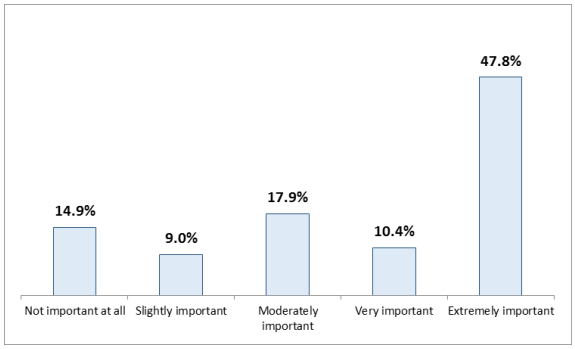
Collated responses to the questions are included in Table 9.

Table 9: Collated responses to the questions posed in Flying Fox Engage

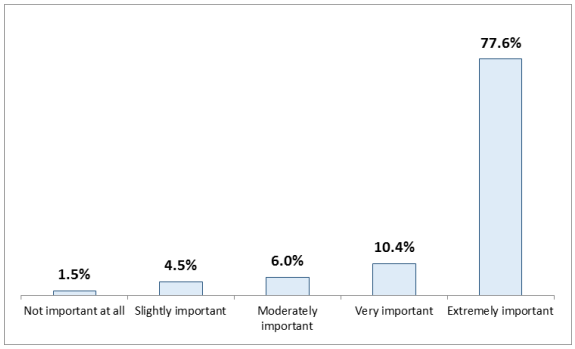
Question Responses	
How important is it to you that the flying-fox camp management option reduces the impact of noise and odour from flying-foxes roosting at the camp on nearby residents?	How important is it to you that the flying-fox camp management option reduces the impact of the flying-fox excrement on the property of nearby residents?
	
How important is it to you that the flying-fox camp management option does not move the flying-fox camp to other areas that may also be near residents or businesses?	How important is it to you that the flying-fox camp management option ensures the risk of disease transmission remains low?
	
How important is it to you that the flying-fox camp management option has a low financial cost to residents living near the flying-fox camp?	How important is it to you that the flying-fox camp management option has a low financial cost to Council ratepayers?
	

Question Responses

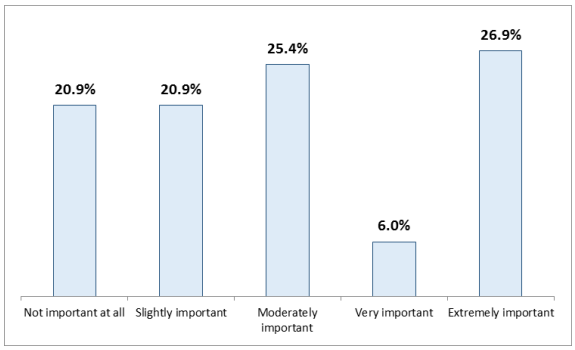
How important is it to you that the flying-fox camp management option can be implemented quickly?



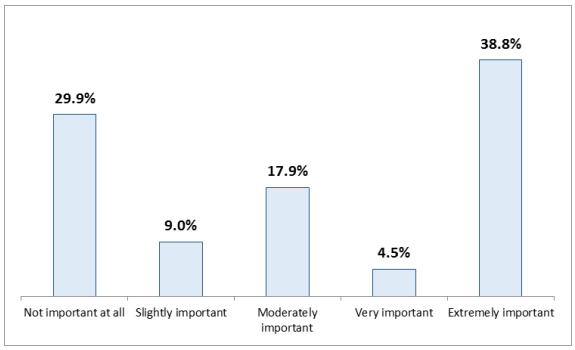
How important is it to you that the flying-fox camp management option provides a long term solution?



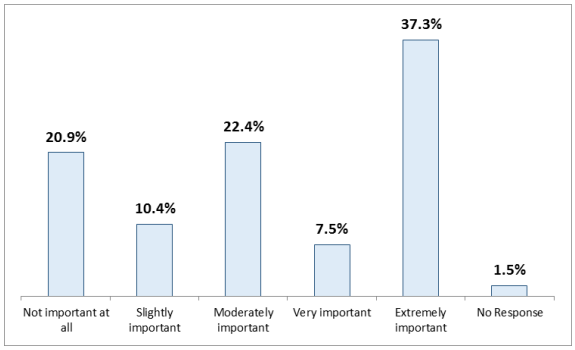
How important is it to you that the flying-fox camp management option does not disrupt residents and businesses during implementation?



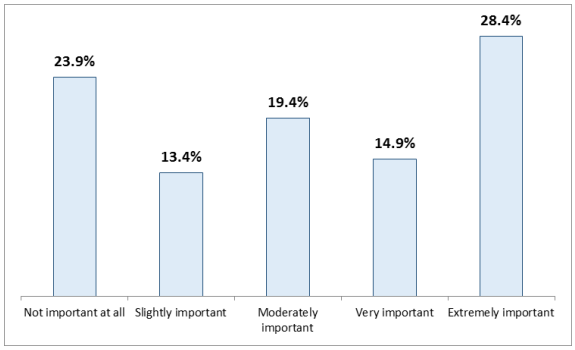
How important is it to you that the flying-fox camp management option does not harm the flying-foxes?



How important is it to you that the flying-fox camp management option does not degrade the natural or ecological values of the site?



How important is it to you that the flying-fox camp management option does not change the visual appeal or recreational opportunities currently undertaken at the site?



As expected, the majority of respondents felt that managing of the impact from Flying-foxes was extremely important, but when asked about cost burden of activities, impact on local environment, and changes to the local amenity; respondents differed in their opinions, with many suggesting these were less important considerations, suggesting the impact (noise and smell) may be sufficient for residents to want to see some reduction of impacts, regardless of cost.

Based on the responses to the questions, Flying Fox Engage was able to rank the various management options that match the responses. Details of the preferred management actions before and after re-ranking is allowed is provided in Table 10.

Table 10: Top 10 community ranked Management Options based on Flying Fox Engage responses

Rank	Initial Result (values based ranking)	Re-ranked result (emotion based ranking)
1	Land-use planning	Health and safety guidelines to manage incidents related to the camp
2	Subsidising property modification to reduce the impacts of flying-foxes	Revegetating areas with plants that are unsuitable as roost habitat
3	Guidelines for carrying out operations adjacent to camps	Subsidising services to reduce the impacts of flying-foxes
4	Health and safety guidelines to manage incidents related to the camp	Subsidising property modification to reduce the impacts of flying-foxes
5	Provision of flying-fox education and awareness programs	Artificial roosting habitat
6	Subsidising services to reduce the impacts of flying-foxes	Early dispersal before a camp is established at a new location
7	Do Nothing	Revegetate and manage land to create alternative flying-fox habitat
8	Artificial roosting habitat	Guidelines for carrying out operations adjacent to camps
9	Research to improve knowledge of flying-fox ecology	Routine maintenance to improve the condition of the site
10	Revegetate and manage land to create alternative flying-fox habitat	Research to improve knowledge of flying-fox ecology

As shown in Table 10, initial values based ranking suggests the community does not want to see any major impact on the Flying-foxes, as the overwhelming majority of preferred management actions are Level 1 activities. When allowed to re-rank the management objectives, largely similar actions are included in the preferred list, with “Early dispersal before a camp is established at a new location” added to the list, as a higher level action.

When considering just those residents within 300m of the Camp (directly impacted), residents in this zone both before and after the re-ranking process only identified Level 1 Actions, with the “Early dispersal before a camp is established at a new location” not appearing in the preferred list at any stage (see Table 11).

Table 11: Top 10 ranked Management Options based on Flying Fox Engage responses from directly affected residents

Rank	Initial Result (values based ranking)	Re-ranked result (emotion based ranking)
1	Land-use planning	Revegetate and manage land to create alternative flying-fox habitat
2	Subsidising property modification to reduce the impacts of flying-foxes	Health and safety guidelines to manage incidents related to the camp
3	Guidelines for carrying out operations adjacent to camps	Subsidising property modification to reduce the impacts of flying-foxes
4	Health and safety guidelines to manage incidents related to the camp	Land-use planning
5	Provision of flying-fox education and awareness programs	Guidelines for carrying out operations adjacent to camps
6	Subsidising services to reduce the impacts of flying-foxes	Revegetating areas with plants that are unsuitable as roost habitat
7	Do Nothing	Subsidising services to reduce the impacts of flying-foxes
8	Artificial roosting habitat	Routine maintenance to improve the condition of the site
9	Research to improve knowledge of flying-fox ecology	Research to improve knowledge of flying-fox ecology
10	Revegetate and manage land to create alternative flying-fox habitat	Early dispersal before a camp is established at a new location

In addition to the 12 questions already discussed, respondents were asked a number of follow up questions, and then were able to provide their own comments for consideration.

Table 12 provides details on the responses.

Table 12: Additional Flying Fox Engage Questions

Question	Responses	Percent of Respondents
Have you experienced the flying-foxes in the camp?	No, I have not experienced the flying-foxes	4.5%
	Yes, flying-foxes from the camp roost in trees that are next to or overhang my home	22.4%
	Yes, flying-foxes leaving and returning to the camp fly over my home	58.2%
	Yes, flying-foxes stop me from using the area, surrounding services or businesses	37.3%

Question	Responses	Percent of Respondents
	Yes, I enjoy visiting the flying-foxes	13.4%
	Yes, my home is very close to the camp	37.3%

The following open-ended questions were posed to the community:

- if you want to, you can comment on the flying-fox camp management options we have explored or you can suggest other solutions; and
- if you want to, please provide comments about this flying fox camp.

The responses to these open ended questions covered a few key areas of concern and are summarized below. Of the total 59 responses:

- 37% expressed concern for noise, odour, mess, and the potential health issues created by the presence of flying foxes
- 27% of responses reaffirmed a need to prioritize the culling or dispersal of flying foxes
- 7% expressed concern about the growing numbers
- 7% expressed concern about habitat loss, and the need to generate addition vegetation to improve habitat.
- 10% of responses highlighted the importance of protecting flying foxes
- 7% mentioned no negative effects of their experiences with bats

In addition to these areas of concern, other responses mentioned,

- concern towards a lack of diligence by council in managing flying foxes,
- concern about their impact on tourism in the area, and
- a need to better educate the community in the ecological importance of flying foxes.

Refer to Appendix 6 for full responses to questions.

4 Management Opportunities

4.1 Site-specific analysis of camp management options

Flying-fox Culling

Culling of Flying-foxes is unlawful as they are a protected species under the *NSW National Parks and Wildlife Act 1974*, and Federally Listed Threatened Species.

Culling is not considered a viable Camp Management action as it is inconsistent with the:

- Commonwealth Environmental Protection & Biodiversity Conservation Act 1999
- NSW National Parks and Wildlife Act 1974
- Firearms Act 1996 or section 96G of the Crimes Act 1900
- NSW Flying-fox Management Policy 2015
- not a preferred management option by the majority of the Cessnock community,
- scientifically ineffective (due to the mobility of the species) and
- objectives of this Camp Management Plan.

The NSW Flying-fox Camp Management Policy 2015 and Camp Management Plan Template 2016 provide details on acceptable management activities to manage and mitigate human / bat conflict at Camp Sites. The management actions are grouped into three levels, and discussed below. A more detailed explanation can be found in Appendix 7.

Routine camp management actions (Level 1 actions)

Routine camp management actions should be clearly identified as Level 1 camp management actions in the camp management plan.

These include:

- removal of tree limbs or whole trees that pose a genuine health and safety risk, as determined by a qualified arborist
- weed removal, including removal of noxious weeds under the Noxious Weeds Act 1993 or species listed as undesirable by a council
- trimming of under-storey vegetation or the planting of vegetation
- minor habitat augmentation for the benefit of the roosting animals
- mowing of grass and similar grounds-keeping actions that will not create a major disturbance to roosting flying-foxes
- application of mulch or removal of leaf litter or other material on the ground.

Creation of buffers (Level 2 actions)

Creation of buffers can be effective as management actions to nudge flying-fox populations away from urban settlements. The intention is to create a physical or visual separation from the camp and actively manage vegetation structure and composition to discourage flying-foxes from roosting close to built areas.

Actions include:

- clearing or trimming canopy trees at the camp boundary to create a buffer
- disturbing animals at the boundary of the camp to encourage roosting away from human settlement.

Camp disturbance or dispersal (Level 3 actions)

Camp dispersal is an action that aims to intentionally move entire camps from one location to another by clearing vegetation or dispersing animals through disturbance by noise, water, smoke or light.

Camp dispersal can remove impacts on local communities and is supported by this policy. However, camp dispersal is challenging for a number of reasons:

- it can be expensive and can have uncertain outcomes.
- dispersal may result in relocating the animals rather than resolving the issue. Past disturbances in Australia have sometimes failed to remove flying-foxes from the area or have resulted in flying-foxes relocating to other nearby areas where similar community impacts have occurred.
- attempts to disperse camps are often contentious.
- disturbing flying-foxes may have an adverse impact on animal health.
- the cumulative impacts of flying-fox camp dispersals may negatively impact on the conservation of the species and the ecosystem services flying-foxes provide.

Table 13 provides details on the various management options available, an assessment of cost and effectiveness of the action to address the various conflict issues. The Table also provides details of the assessment undertaken by Council staff as to the suitability of the actions to be included in the Camp Management Plan consideration has been given to the local context and to the experiences or other Councils in the region. Section 4.2 provides details of the management actions that will be undertaken through the implementation of the Camp Management Plan.

Table 13: Analysis of management options

Management Option	Relevant Impacts	Cost	Advantages	Disadvantages	Suitability Determination
Level 1 Actions					
Education and awareness programs	Fear of disease Noise Smell Faecal drop	$	Low cost, promotes conservation of FFs, contributes to attitude change which may reduce general need for camp intervention, increasing awareness and providing options for landholders to reduce impacts can be an effective long-term solution, can be undertaken quickly, will not impact on ecological or amenity value of the site.	Education and advice itself will not mitigate all issues, and may be seen as not doing enough.	This action was deemed suitable. Responses from Flying Fox Engage indicated a strong desire from the community for more information on Flying Foxes.
Property modification (e.g. car cover, pool cover, clothesline cover, air conditioners, double glaze windows, etc.)	Noise Smell Faecal drop Health/wellbeing Property devaluation Lost rental return	$–$$	Property modification is one of the most effective ways to reduce amenity impacts of a camp without dispersal (and associated risks), relatively low cost, promotes conservation of FFs, can be undertaken quickly, will not impact on the site, may add value to the property.	May be cost-prohibitive for private landholders, unlikely to fully mitigate amenity issues in outdoor areas.	This action was deemed suitable for residents adjacent to the Camp
Fully-fund/subsidise property modification	Noise Smell Faecal drop Health/wellbeing Property devaluation Lost rental return	$–$$	Potential advantages as per property modification, but also overcomes issue of cost for private landholders.	Costs to the land manager will vary depending on the criteria set for the subsidy including proximity to site, term of subsidy, level of subsidy. Potential for community conflict when developing the criteria, and may lead to expectations for similar subsidies for other issues.	This action has limited applicability due to funding constraints. Should funding become available, this option can be further explored. This was the second preference from Flying Fox Engage
Service subsidies (e.g. rate rebates, access to water gurney, etc.)	Noise Smell Faecal drop Health/wellbeing Property devaluation Lost rental return	$–$$	May encourage tolerance of living near a camp, promotes conservation of FFs, can be undertaken quickly, will not impact on the site, would reduce the need for property modification.	May be costly across multiple properties and would incur ongoing costs, may set unrealistic community expectations for other community issues, effort required to determine who would receive subsidies.	Due to lack of funding, this option is not suitable in the short term. Should funding become available in the longer term, this action will be reconsidered. Some services such as water gurney hire are more feasible whilst rate rebates are unlikely.

Management Option	Relevant Impacts	Cost	Advantages	Disadvantages	Suitability Determination
Routine camp management	Health/wellbeing	$	Will allow property maintenance, likely to improve habitat, could improve public perception of the site, will ensure safety risks of a public site can be managed. Weed removal has the potential to reduce roost availability and reduce numbers of roosting FFs. To avoid this, weed removal should be staged and alternative roost habitat planted, otherwise activities may constitute a Level 3 action.	Will not generally mitigate amenity impacts for nearby landholders.	This action was deemed suitable
Provision of artificial roosting habitat	All	$–$$	If successful in attracting FFs away from high conflict areas, artificial roosting habitat in low conflict areas will assist in mitigating all impacts, generally low cost, can be undertaken quickly, promotes FF conservation.	Would need to be combined with other measures (e.g. buffers/alternative habitat creation) to mitigate impacts, previous attempts have had limited success.	This action was not deemed suitable
Protocols to manage incidents	Health/wellbeing	$	Low cost, will reduce actual risk of negative human/pet–FF interactions, promotes conservation of FFs, can be undertaken quickly, will not impact the site.	Will not generally mitigate amenity impacts.	This action will be included as a risk management response by all responsible land managers
Research	All	$	Supporting research to improve understanding may contribute to more effectively mitigating all impacts, promotes FF conservation.	Generally cannot be undertaken quickly, management trials may require further cost input.	This action was deemed more suitable to be included in a regional strategy or plan
Appropriate land-use planning	All	$	Likely to reduce future conflict, promotes FF conservation. Identification of degraded sites that may be suitable for long-term rehabilitation for FFs could facilitate offset strategies should clearing be required under Level 2 actions.	Will not generally mitigate current impacts, land-use restrictions may impact the landholder.	This action was deemed suitable
Property acquisition	All for specific property owners Nil for broader community	$$$	Will reduce future conflict with the owners of acquired property.	Owners may not want to move, only improves amenity for those who fit criteria for acquisition, very expensive.	This action was not deemed suitable due to excessive cost
Do nothing	Nil	Nil	No resource expenditure.	Will not mitigate impacts and unlikely to be considered acceptable by the community.	Due to commitment of Land Managers and Council, this action is not suitable, despite being ranked highly by Flying Fox Engage responses.

Management Option	Relevant Impacts	Cost	Advantages	Disadvantages	Suitability Determination
Level 2 Actions					
Buffers through vegetation removal	Noise Smell Health/wellbeing Property devaluation Lost rental return	$–$$	Will reduce impacts, promotes FF conservation, can be undertaken quickly, limited maintenance costs.	Will impact the site, will not generally eliminate impacts, vegetation removal may not be favoured by the community.	This action was deemed suitable
Buffers without vegetation removal	Noise Smell Health/wellbeing Damage to vegetation Property devaluation Lost rental return	$$	Successful creation of a buffer will reduce impacts, promotes FF conservation, can be undertaken quickly, options without vegetation removal may be preferred by the community.	May impact the site, buffers will not generally eliminate impacts, maintenance costs may be significant, often logistically difficult, limited trials so likely effectiveness unknown.	This action was deemed suitable, however its applicability to the site may be limited
Level 3 Actions					
Nudging	All	$$–$$$	If nudging is successful this may mitigate all impacts.	Costly, FFs will continue attempting to recolonise the area unless combined with habitat modification/ deterrents.	Not deemed suitable due to excessive cost.
Passive dispersal through vegetation management	All at that site but not generally appropriate for amenity impacts only	$$–$$$	If successful can mitigate all impacts at that site, compared with active dispersal: less stress on FFs, less ongoing cost, less restrictive in timing with ability for evening vegetation removal.	Costly, will impact site, risk of removing habitat before outcome known, potential to splinter the camp creating problems at other locations (although less than active dispersal), potential welfare impacts, disturbance to community, negative public perception, unknown conservation impacts, unpredictability makes budgeting and risk assessment difficult, may increase disease risk, potential to impact on aircraft safety.	Not deemed suitable due to the nature of the vegetation (Endangered Ecological Community), the likelihood of shifting the problem onto another section of the community, and cost

Management Option	Relevant Impacts	Cost	Advantages	Disadvantages	Suitability Determination
Passive dispersal through water management	All at that site but not generally appropriate for amenity impacts only	$$–$$$	Potential advantages as per with passive dispersal through vegetation removal, however likelihood of success unknown.	Potential disadvantages as per passive dispersal through vegetation removal, however likelihood of success unknown.	Not deemed suitable for the site due to the impacts on threatened vegetation communities
Active dispersal	All at that site but not generally appropriate for amenity impacts only	$$$	If successful can mitigate all impacts at that site, often stated as the preferred method for impacted community members.	May be very costly, often unsuccessful, ongoing dispersal generally required unless combined with habitat modification, potential to splinter the camp creating problems in other locations, potential for significant animal welfare impacts, disturbance to community, negative public perception, unknown conservation impacts, unpredictability makes budgeting and risk assessment difficult, may increase disease risk, potential to impact on aircraft safety.	Not deemed suitable due to excessive cost and limited likelihood of success.
Early dispersal before a camp is established at a new location	All at that site	$$–$$$	Potential advantages as per other dispersal methods, but more likely to be successful than dispersal of a historic camp.	Potential disadvantages as per other dispersal methods, but possibly less costly and slightly lower risk than dispersing a historic camp. Potential to increase pressure on FFs that may have relocated from another dispersed camp, which may exacerbate impacts on these individuals.	Not applicable to this Camp, however the plan should address the potential likely sites that may be established in the future.

4.2 Planned Management Approach

The planned management approach included in Table 14 has been determined after consideration of community views, ecological requirements and legislative / policy controls. The Actions have been grouped into the major thematic areas of:

1. Resident Assistance
2. Community Education
3. Restoration & Rehabilitation
4. Infrastructure
5. Flying-fox Species Management
6. Routine Management
7. Monitoring
8. Governance

The actions included in Table 14 are directly linked to the management actions discussed in Table 13, but have been directly tailored to actions that will be planned for implementation at the Flying-fox Camp, depending on conditions and funding provision. Responsibility for the implementation of these actions will be shared across the various land managers as required, details of these responsibilities are included in the table.

Table 14: Management Actions

Action ID	Issue	Actions & guidelines	Responsibility	Trigger / Catalyst for commencement	Budget
1. Resident Assistance					
1.1	Car / Clothes-line / swimming pool covers	Provision of these items based upon selection criteria during times of high population occupancy	Port Stephens Council	Camp expansion to greater than 15,000 individuals.	Grant funding required and to be sought.
1.2	Assistance with costs for tree removal and tree removal applications.	Based on limited species, and proximity to camp – roosting trees and/or coccus palms only	Port Stephens Council	Camp expansion to greater than 15,000 individuals and application for removal made to Council	Application fee (approx $70 waived) Removal costs TBD and grant sought
1.3	Preparation and financial assistance with licence (Part 2 Biodiversity Conservation Act) fees	Only applicable to properties within 300m of Camp boundary	Port Stephens Council & OEH	Camp expansion to greater than 15,000 individuals and evidence of >1 month residence in properties.	PSC to assist preparation OEH to waive fees (TBC)
1.4	Access to gurney / water cleaners to remove bat excrement	Access provided only when trigger reached	Port Stephens Council	Camp expansion to greater than 10,000 individuals and application made to Council	$5,000 (5 cordless pressure sprayers for loan)
2. Community Education					

Action ID	Issue	Actions & guidelines	Responsibility	Trigger / Catalyst for commencement	Budget
2.1	Advice on backyard vegetation management	Advice on which trees residents may wish to remove (introduced or naturalised foraging species such as Cocos Palms, Poplars and Silky Oaks) Advice on trees to plant if residents want to encourage bats to forage in their properties. Advice on native fragrant trees that will assist to screen smells from Camp	Port Stephens Council Hunter Joint Organisation of Councils	Included in Regional Flying-fox educational kit	Funded through NSW Environmental Trust 2017-19
2.2	Health and disease management	Develop consistent regional information regarding health concerns	Office of Environment & Heritage. New England Health Hunter Joint Organisation of Councils	Included in Regional Flying-fox educational kit	Funded through NSW Environmental Trust 2017-19
2.3	Lifecycle and nomadic timing of bat arrival	Develop consistent regional information regarding Flying-fox nomadic behaviour	Office of Environment & Heritage. Hunter Joint Organisation of Councils	Included in Regional Flying-fox educational kit	Funded through NSW Environmental Trust 2017-19
2.4	Implement Regional Flying-fox educational kit	Develop a community education kit to assist residents to understand Flying-fox movement patterns and reduce conflicts with Camps	Hunter Joint Organisation of Councils Port Stephens Council	Project expected to deliver kit in November 2017	Funded through NSW Environmental Trust 2017-19
2.5	How to manage dead or injured Flying-foxes	Information on who to call when sick, injured or dead Flying-foxes are seen	Wildlife Carer Group Port Stephens Council	Immediate action required	Within existing budget
3. Restoration & Rehabilitation					
3.1	Assess native recruitment potential where canopy is open	Assessment of vegetation condition improvement in core of site, to make core attractive for roosting	Port Stephens Council	Ongoing	Within PSC budget
3.2	Rehabilitation of areas of open canopy	Removal of damaged vegetation and establishment of replacement vegetation.	Port Stephens Council	Ongoing	PSC in kind $5,000 - grant funding to be sought/leveraged.
3.3	Rehabilitation of damaged areas (from Flying-fox occupation	Removal of damaged vegetation and establishment of replacement vegetation.	Port Stephens Council		
3.4	Weed management and replacement with appropriate indigenous species	Remove weeds	Port Stephens Council		

Action ID	Issue	Actions & guidelines	Responsibility	Trigger / Catalyst for commencement	Budget
3.5	Maintain buffer zone (APZ) on south western boundary of Newbury Park to minimise conflict between residents and Flying-foxes	Supply native fragrant trees and shrubs adjacent to dwellings to reduce the noise and smell directly behind	Port Stephens Council	On request from residents.	Plants supplied free. Planting at resident cost.
3.6	Manage buffer zone (APZ) to reduce conflict between residents and Flying-foxes	Supply native fragrant trees and shrubs adjacent to dwellings to reduce the noise and smell directly behind	Port Stephens Council		
4. Infrastructure					
4.1	Signage	Interpretive Signage	Port Stephens Council	Regional project complete	Regional project success
5. Flying-fox Species Management					
5.1	Flying-fox Rehabilitators response	Respond to calls of injured or dead Flying-foxes	Flying-fox Rehabilitators	Community Calls Wildlife rescue Service	Free service from NATF
5.2	Wildlife rehabilitator alerts (notification of upcoming events, e.g. management activities, heat stress, etc.)	Notification of residents and Wildlife rehabilitator via email/texts of any events that will impact on Camp Site or Flying-fox population.	OEH and Flying-fox Rehabilitators	OEH alerts forwarded to residents subscribing to distribution list	$1,000
6. Routine Management					
6.1	Weed Control	Noxious and environmental weed control throughout the Camp area - targeting exotic tree species known to act as potential roosting and foraging habitat (e.g. Camphor Laurel as most on site are immature or have not reached maximum height)	Port Stephens Council	Ongoing	Within Council budget and processes
6.2	Fire Management	Hazard reduction planning or maintenance (including Asset Protection zones) and wildfire response	Port Stephens Council	Ongoing	Within Council budget and processes
6.3	Dangerous Trees	Assessments for potentially dangerous trees	Port Stephens Council	Ongoing	Within Council budget and processes
6.4	Buffer (Asset Protection Zones) Maintenance	Maintenance of parks and south western Newbury Park buffer	Port Stephens Council	Ongoing	Within Council budget and processes
6.5	Mowing	Routine mowing in and around camp and school	Port Stephens Council	Ongoing	Within Council budget and processes
7. Monitoring					
7.1	Flying-fox Census	Quarterly Flying-fox animal counts to assist with determining likely national population	CSIRO	Quarterly monitoring as part of National Program	Funded by CSIRO

Action ID	Issue	Actions & guidelines	Responsibility	Trigger / Catalyst for commencement	Budget
7.2	Wildlife / Rehabilitation data collection	Collection and provision of count information, and other data collected when responding to calls	Wildlife Carer Group	As responding to issues at the Camp	NA
7.3	Hunter Bird Observers data collection	Collection and provision of count information, and other data collected	Hunter Bird Observers	When aware of flowering event that may signal an increase in flying-fox population	NA
7.3	Port Stephens Council management data	Collection and dissemination of data related to Flying-foxes, and vegetation that may impact on local or regional Flying-fox populations	Port Stephens Council	Ongoing and as made aware of issues	Within existing budget
8. Governance					
8.1	Camp Management Plan review	Review in 5 years / when FF numbers increase past current capacity	Port Stephens Council	5 years from commencement	Within existing budget
8.3	Protocol Development	Fire	RFS	Ongoing as funding allows	Responsible entities
		Heat Stress	Office of Environment & Heritage / Wildlife Rehabilitators		
		Community Response to dead / injured animals	Wildlife Rehabilitators		
		Hospital	New England Health		
		Equine	Hunter Local Land Services		

With regard to routine management, management controls and guidelines are put in place to limit the stress laced on the animals during whilst management is being undertaken. Outlined in Appendix 8 are a range of stop work triggers, signs to identify these, and the actions that must be taken. These have been and will continue to be incorporated into environmental assessments for routine park management activities being undertaken in the vicinity of the camp.

5 Assessment of Impacts to Flying Foxes

5.1 Flying-fox habitat to be affected

Habitat in the parks site will primarily be positively impacted by weeding and planting.

Operational maintenance activities have potential to impact on habitat and threatened species including Grey Headed Flying-foxes

5.2 Assessment of Impacts to Other Threatened Species or Communities

All Council activities will follow Council's Environmental Assessment procedure in accordance with Council's Environmental Management System. Council has conducted an assessment of significance for impacts to threatened species for operational activities. Controls established, reflecting those in Appendix 8, will be developed into standard operational procedures.

All potential residential vegetation removal will require vegetation removal permits (fees waived) or development assessment approvals with associated environmental assessment.

6 Evaluation and Review

The Plan will have a scheduled review annually, which will include evaluation of management actions against measures in Appendix 8.

The following will trigger a reactive review of the Plan:

- completion of a management activity
- progression to a higher level of management
- changes to relevant policy/legislation
- new management techniques becoming available
- outcomes of research that may influence the Plan
- Incidents associated with the camp.

Results of each review will be included in reports to OEH.

If the Plan is to remain current, a full review including stakeholder consultation and expert input will be undertaken in the final year of the Plan's life prior to being re-submitted to OEH.

7 Plan administration

7.1 Monitoring of the camp

Council conducts monthly monitoring of the camp.

Council will continue to assist the CSIRO to undertake their quarterly Flying-fox census activities. Wildlife Rehabilitators can access the site as required to attend to the animals, and record information of relevance to Council, the Office of Environment & Heritage and CSIRO.

Additional monitoring and data collection will occur as opportunities arise.

7.2 Reporting

Annual reports (following publication of the CSIRO Census Count) will be developed by Port Stephens Council and submitted to Council providing details on management activities at the site, and the Flying-fox population during the year.

7.3 Funding commitment

Council has a responsibility to ensure appropriate funding is available to undertake management actions included in this plan. The Plan will operate from 2018 – 2028 and therefore each organisation should ensure ongoing funding, and forward planning for management actions be included in their annual budget development.

It is expected that an annual work plan, including budget items will be developed by the project team and implemented as required.

8 References and additional resources

Aich, P, Potter, AA and Griebel, PJ 2009, 'Modern approaches to understanding stress and disease susceptibility: A review with special emphasis on respiratory disease', *International Journal of General Medicine*, vol. 2, pp. 19–32.

AIHW 2012, *Risk factors contributing to chronic disease*, Cat no. PHE 157, Australian Institute of Health and Welfare, viewed 12 January 2016, www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=10737421546.

Atlas of Living Australia 2015, viewed 12 January 2016, www.ala.org.au.

Australasian Bat Society 2013, viewed 12 January 2016, ausbats.org.au/.

Australian Museum 2010, *Little Red Flying-fox*, viewed 12 January 2016, australianmuseum.net.au/little-red-flying-fox.

AVA 2015, *Hendra virus*, Australian Veterinary Association, viewed 12 January 2016, www.ava.com.au/hendra-virus.

Birt, P 2000, 'Summary information on the status of the Grey-headed (*Pteropus poliocephalus*) and Black (*P. alecto*) Flying-Fox in New South Wales,' Proceedings of workshop to assess the status of the grey-headed flying-fox in New South Wales. University of Sydney, Sydney, New South Wales, Australia, pp. 78-86.

CDC 2014, *Hendra virus disease (HeV): Transmission,* Centers for Disease Control and Prevention, updated 17 March 2014, viewed 12 January 2016, www.cdc.gov/vhf/hendra/transmission/index.html.

Churchill, S 2008, *Australian Bats*, Allen & Unwin, Crows Nest, NSW.

DAF 2012, *Zoonoses are diseases that can spread from animals to people*, Queensland Department of Agriculture and Fisheries, updated 31 January 2012, viewed 12 January 2016, www.daf.qld.gov.au/animal-industries/animal-health-and-diseases/zoonoses.

DECC 2007, *Threatened species assessment guidelines: the assessment of significance*, Department of Environment and Climate Change NSW, Sydney, viewed 12 January 2016, www.environment.nsw.gov.au/resources/threatenedspecies/tsaguide07393.pdf.

DECC 2008, *Best practice guidelines for the grey-headed flying-fox*, Department of Environment and Climate Change NSW, Sydney, viewed 12 January 2016, www.environment.nsw.gov.au/resources/threatenedspecies/08540tsdsflyingfoxbpg.pdf.

DECCW 2009, *Draft National Recovery Plan for the Grey-headed Flying-fox* Pteropus poliocephalus, prepared by Dr Peggy Eby for Department of Environment, Climate Change and Water NSW, Sydney, viewed 12 January 2016, www.environment.nsw.gov.au/resources/threatenedspecies/08214dnrpflyingfox.pdf.

Den Exter, K, Roberts, B, Underwood, A and Martin, L 2011, *A discussion paper on flying foxes and the implications for bush regeneration at their camp sites*, Big Scrub Landcare, posted 28 March 2011, viewed 12 January 2016, bigscrubrainforest.org.au/?p=129.

DoE 2013, *Matters of National Environmental Significance: Significant Impact Guidelines 1.1*, Environment Protection and Biodiversity Conservation Act 1999, Australian Government Department of the Environment, www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf.

DoE 2014, *How can flying-foxes be managed in accordance with national environmental law*? Australian Government Department of the Environment, Canberra, viewed 12 January 2016, www.environment.gov.au/biodiversity/threatened/species/flying-fox-law.

DoE 2015, *Referral guideline for management actions in grey-headed and spectacled flying-fox camps*, Australian Government Department of the Environment, Canberra, viewed 12 January 2016, www.environment.gov.au/system/files/resources/6d4f8ebc-f6a0-49e6-a6b6-82e9c8d55768/files/referral-guideline-flying-fox-camps.pdf.

DoE 2016a, *Pteropus poliocephalus in Species Profile and Threats Database*, Australian Government Department of the Environment, Canberra, viewed 12 January 2016, www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=186.

DoE 2016b, *Monitoring Flying-fox Populations*, Australian Government Department of the Environment, Canberra, viewed 12 January, www.environment.gov.au/biodiversity/threatened/species/flying-fox-monitoring.

DPI 2013, *Australian bat lyssavirus*, June 2013 Primefact 1291 2nd edition, Department of Primary Industries, NSW, viewed 12 January 2016, www.dpi.nsw.gov.au/__data/assets/pdf_file/0011/461873/Australian-Bat-lyssavirus.pdf.

DPI 2014, *Hendra virus*, June 2014 Primefact 970 9th edition, Department of Primary Industries, NSW, viewed 12 January 2016, www.dpi.nsw.gov.au/__data/assets/pdf_file/0019/310492/hendra_virus_primefact_970.pdf.

DPI 2015a, *Hendra virus*, Department of Primary Industries, NSW, viewed 12 January 2016, www.dpi.nsw.gov.au/agriculture/livestock/horses/health/general/hendra-virus.

DPI 2015b, *Lyssavirus and other bat health risks*, Department of Primary Industries, Primary Industry Biosecurity, NSW, viewed 12 January 2016, www.dpi.nsw.gov.au/biosecurity/animal/humans/bat-health-risks.

DSDIP 2014, *Queensland State Planning Policy July 2014*, Department of State Development, Infrastructure and Planning, Brisbane.

Eby, P 1991, 'Seasonal movements of Grey-headed Flying-foxes, *Pteropus poliocephalus* (Chiroptera: Pteropodidae) from two maternity roosts in northern New South Wales'*, Wildlife Research*, vol. 18, pp. 547–59.

Eby, P 1995, *The biology and management of flying-foxes in NSW*, Species management report number 18, Llewellyn, L. (ed.), National Parks and Wildlife Service, Hurstville.

Eby, P 2000, 'The results of four synchronous assessments of relative distribution and abundance of Grey-headed Flying-fox *Pteropus poliocephalus*', Proceedings from workshop to assess the status of the Grey-headed Flying-fox in New South Wales, pp. 66–77.

Eby, P 2006, 'Site Management Plan for the Grey-headed Flying-fox camp at the Sydney Desalination Plant Site', report to Sydney Water Corporation, Sydney.

Eby, P and Lunney, D 2002, *Managing the Grey-headed Flying–fox as a threatened species in NSW*, Royal Society of New South Wales, Darlington, NSW.

Ecosure 2011, 'Hendra Virus Risk Assessment for the Gold Coast Equine Precinct: Residual Risk Report', unpublished report to City of Gold Coast.

Ecosure 2014, *Cannes Reserve flying-fox management strategy*, Ecosure Pty Ltd, report to Pittwater Council, Sydney.

Ecosure 2014, 'Outcomes of a new flying-fox management framework: Review of management actions 2013–2014', unpublished data collected in collaboration with Griffith University (Industry Affiliates Program).

Edson, D, Field, H, McMichael, L, Jordan, D, Kung, N, Mayer, D and Smith, C 2015, 'Flying-fox Roost Disturbance and Hendra Virus Spillover Risk', *PLoS ONE,* vol. 10, no. 5, viewed 12 January 2016, www.ncbi.nlm.nih.gov/pmc/articles/PMC4446312/pdf/pone.0125881.pdf.

EHP 2012, *Living with Wildlife – Flying-foxes*, Department of Environment and Heritage Protection, Queensland, updated 14 May 2012, viewed 12 January 2016, www.ehp.qld.gov.au/wildlife/livingwith/flyingfoxes/importance.html.

EHP 2013a, *Code of Practice – Ecologically sustainable management of flying-fox roosts*, Department of Environment and Heritage Protection, Queensland, viewed 12 January 2016, www.ehp.qld.gov.au/wildlife/livingwith/flyingfoxes/roost-management.html.

EHP 2013b, *Code of Practice – Low impact activities affecting flying-fox roosts*, Department of Environment and Heritage Protection, Queensland, viewed 12 January 2016, www.ehp.qld.gov.au/wildlife/livingwith/flyingfoxes/roost-management.html.

EHP 2013c, *Flying-fox roost management guideline*, Department of Environment and Heritage Protection, Queensland, viewed 12 January 2016, www.ehp.qld.gov.au/wildlife/livingwith/flyingfoxes/roost-management.html.

ELW&P 2015, *Flying-foxes*, Department of Environment, Land, Water and Planning, State of Victoria.

EPA 2013, *Noise Guide for Local Government*, Environment Protection Authority, Sydney.

Fujita, MS 1991, 'Flying-fox (*Chiroptera: Pteropodidae*) pollination, seed dispersal, and economic importance: a tabular summary of current knowledge', *Resource Publication No. 2*, Bat Conservation International.

GeoLINK 2010, *Maclean Flying-fox Management Strategy,* report prepared for Clarence Valley Council on behalf of the Maclean Flying-Fox Working Group.

GeoLINK 2012*, Lorn Flying-fox management strategy,* report prepared for Maitland City Council.

Hall, L and Richards, G 2000, *Flying foxes: fruit and blossom bats of Australia*, UNSW Press, Sydney.

Henry, JP and Stephens-Larson, P 1985, 'Specific effects of stress on disease processes' in Moberg, GP (ed.), *Animal Stress*, American Physiological Society, pp.161–175.

IUCN 2015, *Little red flying-fox*, International Union for the Conservation of Nature, www.iucnredlist.org.

Ku-ring-gai Council 2013, *Ku-ring-gai Flying-fox Reserve Management Plan*, Ku-ring-gai Council, Gordon, NSW.

Lunney, D, Richards, G and Dickman, C 2008, *Pteropus poliocephalus*, The IUCN Red List of Threatened Species 2008: e.T18751A8554062, dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T18751A8554062.en.

Lunney, D, Richards, G and Dickman, C 2008, *Pteropus poliocephalus*, in IUCN 2011, *IUCN Red List of Threatened Species*, Version 2011.2, viewed 12 January 2016, www.iucnredlist.org.

Markus, N 2002, 'Behaviour of the Black Flying-fox *Pteropus alecto*: 2. Territoriality and courtship', *Acta Chiropterologica*, vol. 4, no. 2, pp.153–166.

Markus, N and Blackshaw, JK 2002, 'Behaviour of the Black Flying-fox *Pteropus alecto*: 1. An ethogram of behaviour, and preliminary characterisation of mother-infant interactions', *Acta Chiropterologica*, vol. 4, no. 2, pp. 137–152.

Markus, N and Hall, L 2004, 'Foraging behaviour of the black flying-fox (*Pteropus alecto*) in the urban landscape of Brisbane, Queensland', *Wildlife Research*, vol. 31, no. 3, pp. 345-355.

McCall, BJ, Field, H, Smith, GA, Storie, GJ and Harrower, BJ 2005, 'Defining the risk of human exposure to Australian bat lyssavirus through potential non-bat animal infection', *CDI*, vol. 29, no. 2, pp. 200–203, www.health.gov.au/internet/main/publishing.nsf/content/cda-cdi2902-pdf-cnt.htm/$FILE/cdi2902k.pdf.

McConkey, KR, Prasad, S, Corlett, RT, Campos-Arceiz, A, Brodie, JF, Rogers, H and Santamaria, L 2012, 'Seed dispersal in changing landscapes', *Biological Conservation*, vol. 146, pp. 1–13, doi:10.1016/j.biocon.2011.09.018.

McGuckin, MA and Blackshaw, AW 1991, 'Seasonal changes in testicular size, plasma testosterone concentration and body weight in captive flying-foxes (*Pteropus poliocephalus* and *P. scapulatus*)', *Journal of Reproduction and Fertility*, vol. 92, pp. 339–346.

McIlwee, AP and Martin, IL 2002, 'On the intrinsic capacity for increase of Australian flying-foxes', *Australian Zoologist*, vol. 32, no. 1.

Milne, DJ and Pavey, CR 2011, 'The status and conservation of bats in the Northern Territory', in Law, B, Eby, P, Lunney, D and Lumsden, L (eds), *The Biology and Conservation of Australasian Bats*, Royal Zoological Society of NSW, Mosman, NSW, pp. 208–225.

NSW Health 2012, *Flying foxes and health*, NSW Health, North Sydney, viewed 12 January 2016, www.health.nsw.gov.au/environment/factsheets/Pages/flying-foxes.aspx.

NSW Health 2013, *Rabies and Australian Bat Lyssavirus Infection*, NSW Health, North Sydney, viewed 12 January 2016, www.health.nsw.gov.au/Infectious/factsheets/Pages/Rabies-Australian-Bat-Lyssavirus-Infection.aspx.

OEH 2011a, *Grey-headed Flying-fox vulnerable species listing: NSW Scientific Committee final determination*, Office of Environment and Heritage, Sydney, viewed 12 January 2016, www.environment.nsw.gov.au/determinations/GreyheadedFlyingFoxVulSpListing.htm.

OEH 2011b, *NSW Code of Practice for Injured, Sick and Orphaned Protected Fauna*, Office of Environment and Heritage, Sydney, viewed 12 January 2016, www.environment.nsw.gov.au/resources/wildlifelicences/110004FaunaRehab.pdf.

OEH 2012, *NSW Code of Practice for Injured, Sick and Orphaned Flying-foxes*, Office of Environment and Heritage, Sydney, viewed 12 January 2016, www.environment.nsw.gov.au/resources/wildlifelicences/120026flyingfoxcode.pdf.

OEH 2014, *BioBanking Assessment Methodology 2014*, Office of Environment and Heritage, Sydney, viewed 12 January 2016, www.environment.nsw.gov.au/resources/biobanking/140661BBAM.pdf.

OEH 2015a, *Flying-foxes* (including fact sheets), Office of Environment and Heritage, Sydney, viewed 12 January 2016, www.environment.nsw.gov.au/animals/flyingfoxes.htm.

OEH 2015b, *Flying-fox Camp Management Policy 2015*, Office of Environment and Heritage, Sydney, viewed 12 January 2016, www.environment.nsw.gov.au/resources/threatenedspecies/150070-flyingfoxcamp-policy.pdf.

OEH 2015c, *Flying-fox Camp Management Plan Template 2015*, Office of Environment & Heritage, Sydney, viewed 12 January 2016, www.environment.nsw.gov.au/resources/threatenedspecies/150102-flyingfoxcamp-template.pdf.

OEH 2015d, *GHFF threatened species profile*, Office of Environment and Heritage, Sydney, viewed 12 January 2016, www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10697

OEH 2015e, *Policy and procedural guidelines for the mitigation of commercial crop damage by flying-foxes*, Office of Environment and Heritage, Sydney, viewed 12 January 2016, www.environment.nsw.gov.au/resources/wildlifelicences/140480FlyfoxPol.pdf

Parry-Jones, KA and Augee, ML 1992, 'Movements of the Grey-headed Flying Foxes (*Pteropus poliocephalus*) to and from a colony site on the central coast of New South Wales', *Wildlife Research,* vol. 19, pp. 331–40.

Parry-Jones, K and Augee, M 2001 'Factors affecting the occupation of a colony site in Sydney, New South Wales by the Grey-headed Flying-fox *Pteropus poliocephalus* (Pteropodidae)', *Austral Ecology*, vol. 26, pp. 47–55.

Pierson, ED and Rainey, WE 1992, 'The biology of flying foxes of the genus Pteropus: A Review', in: Wilson, DE and GL Graham (eds), *Pacific Island Flying Foxes*: *Proceedings of an International Conservation Conference*, US Department of the Interior – Biological Report no. 90, pp. 1–17.

Qld Health 2016, *Bats and Human Health*, Queensland Health, viewed 12 January 2016, www.health.qld.gov.au/communicablediseases/hendra.asp

Ratcliffe, F 1932, 'Notes on the Fruit Bats (Pteropus spp.) of Australia', *Journal of Animal Ecology*, vol. 1, no. 1, pp. 32–57.

Roberts, B 2005, 'Habitat characteristics of flying-fox camps in south-east Queensland', BSc. Honours Thesis, Griffith University, Brisbane.

Roberts, BJ 2006, *Management of Urban Flying-fox Roosts: Issues of Relevance to Roosts in the Lower Clarence, NSW*, Valley Watch Inc, Maclean.

Roberts, B and Eby, P 2013, Review of past flying-fox dispersal actions between 1990–2013, publisher unknown, viewed 12 January 2016, www.environment.nsw.gov.au/resources/animals/flying-fox-2014-subs/flyingfoxsub-jenny-beatson-part2.pdf.

Roberts, BJ, Catterall, CP, Eby, P and Kanowski, J 2012, 'Long-Distance and Frequent Movements of the Flying-Fox *Pteropus poliocephalus*: Implications for Management', *PLoS ONE*, vol. 7, no. 8, e42532.

Roberts, BJ, Eby, P, Catterall, CP, Kanowski, J and Bennett, G 2011, 'The outcomes and costs of relocating flying-fox camps: insights from the case of Maclean, Australia', in Law, B, Eby, P, Lunney, D and Lumsden, L (eds), *The Biology and Conservation of Australasian Bats*, Royal Zoological Society of NSW, Mosman, NSW, viewed 12 January 2016, www.griffith.edu.au/__data/assets/pdf_file/0006/358440/Roberts-et-al.pdf.

Roberts, B, Kanowski, J and Catterall, C 2006, *Ecology and Management of Flying-fox Camps in an Urbanising Region*, Rainforest CRC Tropical Forest Landscapes, Issue 5, viewed 12 January 2016, www.rainforest-crc.jcu.edu.au/issues/ITFL_flyingfox.pdf.

SEQ Catchments 2012, *Management and Restoration of flying-fox Roosts: Guidelines and Recommendations*, SEQ Catchments Ltd funded by the Australian Government's Caring for Our Country, viewed 12 January 2016, www.environment.nsw.gov.au/resources/animals/flying-fox-2014-subs/flyingfoxsub-jenny-beatson-part3.pdf.

Shinwari, MW, Annand, EJ, Driver, L, Warrilow, D, Harrower, B, Allcock, RJN, Pukallus, D, Harper J, Bingham, J, Kung, N and Diallo, IS 2014, 'Australian bat lyssavirus infection in two horses', *Veterinary Microbiology*, vol. 173, pp. 224–231.

Southerton, SG, Birt, P, Porter, J and Ford, HA 2004, 'Review of gene movement by bats and birds and its potential significance for eucalypt plantation forestry', *Australian Forestry*, vol. 67, no. 1, pp. 45–54.

Stanvic, S, McDonald, V and Collins, L 2013, *Managing heat stress in flying-foxes colonies*, viewed 12 January 2016, www.fourthcrossingwildlife.com/HeatStress-StanvicMcDonaldCollins.pdf.

Tait, J, Perotto-Baldivieso, HL, McKeown, A and Westcott, DA 2014, 'Are Flying-Foxes Coming to Town? Urbanisation of the Spectacled Flying-Fox (*Pteropus conspicillatus*) in Australia', *PLoS ONE*, vol. 9, no. 10, e109810, doi:10.1371/journal.pone.0109810.

Tidemann, C, Eby, P, Parry-Jones, K and Vardon, M 1999, *The Action Plan for Australian Bats: Grey-headed Flying-fox*, Environment Australia, www.environment.gov.au/node/14622.

Tolga Bat Hospital, *Wildlife Friendly Fencing Project*, Tolga Bat Hospital partly funded by grants from WWF and Australian Government Caring for Our Country, viewed 12 January, 2016, www.wildlifefriendlyfencing.com/WFF/Home.html.

Vardon, MJ and Tidemann, CR 1999, 'Flying-foxes (*Pteropus alecto* and *P. scapulatus*) in the Darwin region, north Australia: patterns in camp size and structure', *Australian Journal of Zoology*, vol. 47, pp. 411–423.

Vardon, MJ, Brocklehurst, PS, Woinarski, JCZ, Cunningham, RB, Donnelly, CF and Tidemann, CR 2001, 'Seasonal habitat use by flying-foxes, *Pteropus alecto* and *P. Scapulatus* (Megachiroptera), in monsoonal Australia', *Journal of Zoology* London, vol. 253, pp. 523–535.

Webb, N and Tidemann, C 1995, 'Hybridisation between black (*Pteropus alecto*) and grey-headed (*P. poliocephalus*) flying-foxes (Megachiroptera: Pteropodidae)', *Australian Mammalogy*, vol. 18, pp. 19–26.

Webb, NJ and Tidemann, CR 1996, 'Mobility of Australian flying-foxes, *Pteropus* spp. (Megachiroptera): evidence from genetic variation', *Proceedings of the Royal Society London Series B,* vol. 263, pp. 497–502.

Welbergen, JA 2014, 'Canaries in the coalmine: flying-foxes and extreme heat events in a warming climate', presentation at the Griffith Climate Change Seminar, July 2014, www.griffith.edu.au/research/research-excellence/griffith-climate-change-response-program/program/?a=628188.

Welbergen, JA, Klose, SM, Markus, N and Eby, P 2008, 'Climate change and the effects of temperature extremes on Australian flying-foxes', *Proceedings of the Royal Society of London B: Biological Sciences*, vol. 275, no. 1633, pp.419–425, viewed 12 January 2016, rspb.royalsocietypublishing.org/content/275/1633/419.short.

Westcott, DA, Dennis, AJ, Bradford, MG, McKeown, A and Harrington, GN 2008, 'Seed dispersal processes in Australia's Wet Tropics rainforests', in Stork, N and Turton, S, *Living in a dynamic tropical forest landscape*, Blackwells Publishing, Malden, pp. 210–223.

Westcott, DA, McKeown, A, Murphy, HT and Fletcher, CS 2011, *A monitoring method for the Grey-headed Flying-fox,* Pteropus poliocephalus, CSIRO, Queensland, viewed 12 January 2016, www.environment.gov.au/biodiversity/threatened/species/pubs/310112-monitoring-methodology.pdf.

Zurbuchen, A, Landert, L, Klaiber, J, Muller, A, Hein, S and Dorn, S 2010, 'Maximum foraging ranges in solitary bees: only few individuals have the capability to cover long-foraging distances', *Biological Conservation,* vol. 142, no. 3, pp. 669–676.

Appendix 1 National Flying-fox Population and Statistics

Scientific Committee Recommendation for Listing as a Nationally Vulnerable Species

Advice to the Federal Minister for the Environment and Heritage from the Threatened Species Scientific Committee (TSSC) on Amendments to the list of Threatened Species under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) recommended Grey Headed Flying-foxes should be listed as Vulnerable due to the decline in the National Population over the preceding years[5].

The Committee noted population size data obtained by fly-out count surveys contain a degree of error that is difficult to quantify (related to the survey methodology; and the comparability of the survey results for the purpose of calculating trends in population size or species abundance). Fly-out counts are acknowledged by the scientific community to be the best method currently available of obtaining reliable and reproducible estimates of abundance (if not actual population counts) for flying-foxes. The available data for 1989 and 1998-2001 has been obtained using the same survey techniques that are widely acknowledged to be appropriate for estimating the abundance of this species.

The data available from the fly-out counts conducted should be regarded as estimates of abundance, rather than precise population counts.

The surveys of 1998-2001 have been much more comprehensive than the 1989 survey in terms of the number of roosts and extent of geographical range included. Despite the significantly increased knowledge of the species roost sites and survey effort, the estimates of abundance obtained indicate a decline in the abundance of the species. Using the maximum estimate from the 1998-2001 surveys (400,000) and the minimum estimate of abundance in 1989 (566,000), the rate of decline since 1989 has been in the order of 30%.

A number of experts commented that the projected habitat clearance in northern NSW is the primary ongoing threat to Grey-headed Flying-foxes. One expert stated that annually reliable winter resources are limited in distribution to a narrow coastal strip in northern NSW and Queensland. These coastal areas are targeted for intensive residential development to cater for a projected 25% increase in the human population over the next decade. It was this argument that convinced the Editorial Panel of the Bat Action Plan to identify Grey-headed Flying-foxes as vulnerable, although the Editorial Panel was not unanimous in its decision.

[5] http://www.environment.gov.au/biodiversity/threatened/conservation-advices/pteropus-poliocephalus, accessed 27 March 2017.

Appendix 2 Vegetation Assessment

The rapid vegetation assessments undertaken identified the dominant species present throughout the various stratum, as described below.

Newbury Park – central southern boundary

Species	Common Name	Stratum	Percentage Cover
Casuarina glauca	Swamp She-oak	Upper	25-50%
Calochlaena dubia	Soft Bracken	Ground	25-50%
Parsonsia straminae	Monkey Vine	Mid	<5%
**Lonicera japonica*	Honey Suckle	Mid	<5%
Typha spp.	Bull Rush	Mid	<5%
**Anredera cordifolia*	Madeira Vine	Mid	<5%
**Tradescantia fluminensis*	Wandering Jew	Ground	5-25%

*-Exotic

Ross Walbridge Reserve – central northern boundary

Species	Common Name	Stratum	Percentage Cover
Casuarina glauca	Swamp She-oak	Upper	5-25%
Melaleuca quinquenervia	Broad-leaved Paperbark	Ground	50-75%
**Sorghum halepense*	Johnson Grass	Mid	50-75%
Cupaniopsis anacardioides	Tuckeroo	Upper	<1%
**Solanum mauritianum*	Wild Tobacco	Mid	<1%
Sida rhombifolia	Paddy's Lucerne	Mid	5-75%
Grevillea robusta	Silky Oak	Ground	<5%
Callistemon salignus	Willow Bottlebrush	Upper	<5%
**Asparagus asparagoides*	Bridal Creeper	Mid	<5%
Calochlaena dubia	Soft Bracken	Ground	5- 25%

*-Exotic

Appendix 3 Animal and Human Health

Disease and flying-fox management

A recent study at several camps before, during and after disturbance (Edson et al. 2015) showed no statistical association between HeV prevalence and flying-fox disturbance. However the consequences of chronic or ongoing disturbance and harassment and its effect on HeV infection were not within the scope of the study and are therefore unknown.

The effects of stress are linked to increased susceptibility and expression of disease in both humans (AIHW 2012) and animals (Henry & Stephens-Larson 1985; Aich et. al. 2009), including reduced immunity to disease.

Therefore it can be assumed that management actions which may cause stress (e.g. dispersal), particularly over a prolonged period or at times where other stressors are increased (e.g. food shortages, habitat fragmentation, etc.), are likely to increase the susceptibility and prevalence of disease within the flying-fox population, and consequently the risk of transfer to humans.

Furthermore, management actions or natural environmental changes may increase disease risk by:

- forcing flying-foxes into closer proximity to one another, increasing the probability of disease transfer between individuals and within the population
- resulting in abortions and/or dropped young if inappropriate methods are used during critical periods of the breeding cycle. This will increase the likelihood of direct interaction between flying-foxes and the public, and potential for disease exposure
- adoption of inhumane methods with potential to cause injury which would increase the likelihood of the community coming into contact with injured/dying flying-foxes.

The potential to increase disease risk should be carefully considered as part of a full risk assessment when determining the appropriate level of management and the associated mitigation measures required.

Australian bat lyssavirus

ABLV is a rabies-like virus that may be found in all flying-fox species on mainland Australia. It has also been found in an insectivorous microbat and it is assumed it may be carried by any bat species. The probability of human infection with ABLV is very low with less than 1% of the flying-fox population being affected (DPI 2013) and transmission requiring direct contact with an infected animal that is secreting the virus. In Australia three people have died from ABLV infection since the virus was identified in 1996 (NSW Health 2013).

Domestic animals are also at risk if exposed to ABLV. In 2013, ABLV infections were identified in two horses (Shinwari et al. 2014). There have been no confirmed cases of ABLV in dogs in Australia; however, transmission is possible (McCall et al. 2005) and consultation with a veterinarian should be sought if exposure is suspected.

Transmission of the virus from bats to humans is through a bite or scratch, but may have potential to be transferred if bat saliva directly contacts the eyes, nose, mouth or broken skin. ABLV is unlikely to survive in the environment for more than a few hours, especially in dry environments that are exposed to sunlight (NSW Health 2013).

Transmission of closely related viruses suggests that contact or exposure to bat faeces, urine or blood does not pose a risk of exposure to ABLV, nor does living, playing or walking near bat roosting areas (NSW Health 2013).

The incubation period in humans is assumed similar to rabies and variable between two weeks and several years. Similarly the disease in humans presents essentially the same clinical picture as classical rabies. Once clinical signs have developed the infection is invariably fatal. However, infection can easily be prevented by avoiding direct contact with bats (i.e. handling). Pre-exposure vaccination provides reliable protection from the disease for people who are likely to have direct contact with bats, and it is generally a mandatory workplace health and safety requirement that all persons working with bats receive pre-vaccination and have their level of protection regularly assessed. Like classical rabies, ABLV infection in humans also appears to be effectively treated using post-exposure vaccination and so any person who suspects they have been exposed should seek immediate

medical treatment. Post-exposure vaccination is usually ineffective once clinical manifestations of the disease have commenced.

If a person is bitten or scratched by a bat they should:

- wash the wound with soap and water for at least five minutes (do not scrub)
- contact their doctor immediately to arrange for post-exposure vaccinations.

If bat saliva contacts the eyes, nose, mouth or an open wound, flush thoroughly with water and seek immediate medical advice.

Hendra virus

Flying-foxes are the natural host for Hendra virus (HeV), which can be transmitted from flying-foxes to horses. Infected horses sometimes amplify the virus and can then transmit it to other horses, humans and on two occasions, dogs (DPI 2014). There is no evidence that the virus can be passed directly from flying-foxes to humans or to dogs (AVA 2015). Clinical studies have shown cats, pigs, ferrets and guinea pigs can carry the infection (DPI 2015a).

Although the virus is periodically present in flying-fox populations across Australia, the likelihood of horses becoming infected is low and consequently human infection is extremely rare. Horses are thought to contract the disease after ingesting forage or water contaminated primarily with flying-fox urine (CDC 2014).

Humans may contract the disease after close contact with an infected horse. HeV infection in humans presents as a serious and often fatal respiratory and/or neurological disease and there is currently no effective post-exposure treatment or vaccine available for people. The mortality rate in horses is greater than 70% (DPI 2014). Since 1994, 81 horses have died and four of the seven people infected with HeV have lost their lives (DPI 2014).

Previous studies have shown that HeV spillover events have been associated with foraging flying-foxes rather than camp locations. Therefore risk is considered similar at any location within the range of flying-fox species and all horse owners should be vigilant. Vaccination of horses can protect horses and subsequently humans from infection (DPI 2014), as can appropriate horse husbandry (e.g. covering food and water troughs, fencing flying-fox foraging trees in paddocks, etc.).

Although all human cases of HeV to date have been contracted from infected horses and direct transmission from bats to humans has not yet been reported, particular care should be taken by select occupational groups that could be uniquely exposed. For example, persons who may be exposed to high levels of HeV via aerosol of heavily contaminated substrate should consider additional PPE (e.g. respiratory filters), and potentially dampening down dry dusty substrate.

Menangle virus

Menangle virus (also known as bat paramyxovirus no. 2) was first isolated from stillborn piglets from a NSW piggery in 1997. Little is known about the epidemiology of this virus, except that it has been recorded in flying-foxes, pigs and humans (AVA 2015). The virus caused reproductive failure in pigs and severe febrile (flu-like) illness in two piggery workers employed at the same Menangle piggery where the virus was recorded (AVA 2015). The virus is thought to have been transmitted to the pigs from flying-foxes via an oral–faecal matter route (AVA 2015). Flying-foxes had been recorded flying over the pig yards prior to the occurrence of disease symptoms. The two infected piggery workers made a full recovery and this has been the only case of Menangle virus recorded in Australia.

General health considerations

Flying-foxes, like all animals, carry bacteria and other microorganisms in their guts, some of which are potentially pathogenic to other species. Direct contact with faecal material should be avoided and general hygiene measures taken to reduce the low risk of gastrointestinal and other disease.

Contamination of water supplies by any animal excreta (birds, amphibians and mammals such as flying-foxes) poses a health risk to humans. Household tanks should be designed to minimise potential contamination, such as using first flush diverters to divert contaminants before they enter

water tanks. Trimming vegetation overhanging the catchment area (e.g. the roof of a house) will also reduce wildlife activity and associated potential contamination. Tanks should also be appropriately maintained and flushed, and catchment areas regularly cleaned to remove potential contaminants.

Public water supplies are regularly monitored for harmful microorganisms, and are filtered and disinfected before being distributed. Management plans for community supplies should consider whether any large congregation of animals, including flying-foxes, occurs near the supply or catchment area. Where they do occur, increased frequency of monitoring should be considered to ensure early detection and management of contaminants.

Appendix 4 Key Legislation

OEH recommends that councils and other land managers prepare a Camp Management Plan, regardless of the legislation under which the proposed management activities are to be assessed. This will ensure that the land manager and surrounding communities are clear about the proposed management, and that appropriate consideration is given to the conservation and welfare of threatened species, the needs and interests of the surrounding community, and a range of other factors.

Local government legislation

Local government is required to prepare planning schemes (including Environmental Planning Instruments and Development Control Plans) consistent with provisions under the Environmental Planning and Assessment Act 1979 (EP&A Act; see Section 4.1.5 of the template).

Local Environment Plans are environmental planning instruments that are legal documents and that relate to a local government area. Other environmental planning instruments, such as State Environmental Planning Policies (SEPPs), may relate to the whole or part of the state. A development control plan provides detailed planning and design guidelines to support the planning controls in a Local Environment Plan, but they are not legal documents.

Planning schemes enable a local government authority to manage growth and change in their local government area (LGA) through land use and administrative definitions, zones, overlays, infrastructure planning provisions, assessment codes and other administrative provisions. A planning scheme identifies the kind of development requiring approval, as well as zoning all areas within the LGA based on the environmental values and development requirements of that land. Planning schemes could potentially include a flying-fox habitat overlay, and may designate some habitat as flying-fox conservation areas.

State legislation

Flying-fox Camp Management Policy 2015

The Flying-fox Camp Management Policy 2015 (the Policy) has been developed to empower land managers, primarily local councils, to work with their communities to manage flying-fox camps effectively. It provides the framework within which OEH will make regulatory decisions. In particular, the Policy strongly encourages local councils and other land managers to prepare Camp Management Plans for sites where the local community is affected.

Draft Code of Practice Authorising Flying-fox Camp Management Actions

In April 2018 the NSW Government consulted on a *Draft Code of Practice Authorising Flying-fox Camp Management Actions*. The draft code is intended to provide councils with greater management flexibility and opportunities to be more proactive in camp management. Councils of the Hunter region provided a combined submission coordinated by Hunter Councils that communication concerns around uncertainty, the practicality of the code and conflicts between the code and existing legislation. Consultation has finished on the draft code and Council awaits further information from the NSW Government.

Regardless of the consultation outcome and implementation, future decision making and activity under the potential code will still require the existence of Camp Management Plans that are necessary to establish and acknowledge the ecological benefits of camps, community expectations and the heavy burden placed on local residents to inform decision making.

Biodiversity Conservation Act 2016/Threatened Species Conservation Act 1995

The Biodiversity Conservation Act 2016 replaced the *Threatened Species Conservation Act 1995* (TSC Act) and maintained objectives to conserve biological diversity and protect the critical habitat of threatened species, populations and ecological communities. The grey-headed flying-fox is listed as threatened under the BC Act (see also Why the Grey-headed Flying-fox is listed as a threatened species).

A threatened species licence, a class of biodiversity conservation licence under Part 2 of the BC Act, may be required if an action is likely to result in:

- harm to an animal that is a threatened species or part of an ecological community
- picking a plant that is a threatened species or part of an ecological community
- damage to a habitat of a threatened species or ecological community
- damage to a declared area of outstanding biodiversity conservation value.

An assessment of impacts is required for any threatened species or their habitat, population, or ecological community that may be impacted by actions proposed in the Plan. Further detail is provided in Section 5.2.

Section 7.3 of the BC Act provides factors (the 5-part test) to assess whether the proposed action is likely to have a significant effect on any threatened species or their habitats, population or ecological community (note, this is therefore not just applicable to flying-foxes). If a significant effect is likely, it may require a species impact statement (SIS) to be prepared and publicly exhibited or the NSW Biodiversity Offset Scheme may apply. If OEH assesses a licence application and determines that a significant impact is unlikely, a section 95 certificate will be issued (Appendix A in the Policy provides a flow chart for this process).

National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) provides for the conservation of nature, 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 are protected under the NPW Act. All native fauna, including flying-foxes, are specifically protected under section 98.

Under this Act, licences can be issued for actions such as harming or obtaining any protected fauna for specified purposes, picking protected plants or damaging habitat of a threatened species, population or ecological community. Note that the definition of 'harm' includes to *hunt, shoot, poison, net, snare, spear, pursue, capture, trap, injure or kill*. The definition of '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*.

Some camps may only have little red flying-fox and/or black flying-fox records (not threatened, but protected under the NPW Act) and no grey-headed flying-fox records (listed as threatened under the BC Act), in which case a licence under section 120 of the NPW Act may apply.

Note that OEH is unlikely to support any actions proposed in a Camp Management Plan that involves dispersal of flying-foxes from lands under National Parks and Wildlife Service (NPWS) control.

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. Adhering to welfare and conservation measures provided in Appendix 8 will ensure compliance with this Act.

Environmental Planning and Assessment Act 1979

The objects of the *Environmental Planning and Assessment Act 1979* (EP&A Act) are to encourage proper management, development and conservation of resources, for the purpose of the social and economic welfare of the community and a better environment. It also aims to share responsibility for environmental planning between different levels of government and promote public participation in environmental planning and assessment.

The EP&A Act is administered by the NSW Department of Planning and Environment.

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

Development under Part 4 of the Act does not require licensing under the BC Act.

Where public authorities such as local councils undertake development under Part 5 of the EP&A Act (known as 'development without consent' or 'activity'), assessment and licensing under the BC Act may not be required. However a full consideration of the development's potential impacts on threatened species will be required in all cases.

Where flying-fox camps occur on private land, land owners are not eligible to apply for development under Part 5 of the EP&A Act. Private land owners should contact Council to explore management options for camps that occur on private land.

Rural Fires Act 1997

The objects of this Act are to prevent, mitigate and suppress bushfires and coordinate bush firefighting, while protecting persons from injury or death, and reduce property damage from fire. A permit is generally required from the Rural Fire Service for any fires in the open that are lit during the local Bush Fire Danger Period as determined each year. This may be relevant for fires used to disperse flying-foxes, or for any burning associated with vegetation management.

Protection of the Environment Operations Act 1997

The main object of the Protection of the Environment Operations Act 1997 (POEO Act) is to set out explicit protection of the environment polices (PEPs) and adopt more innovative approaches to reducing pollution.

The use of smoke as a dispersal mechanism may constitute 'chemical production' under Schedule 1, clause 8 of the POEO Act, so this type of dispersal activity may require a licence under Chapter 3 of the Act.

The POEO Act also regulates noise including 'offensive noise'. The Protection of the Environment Operations (Noise Control) Regulation 2008 (Part 4, Division 2) provides information on the types of noise that can be 'offensive' and for which the Environment Protection Authority (EPA) can issue fines. This may include noise generated as a part of dispersal activities. It is best to discuss the types of noise makers and the sound levels and times these will be generated, along with identified noise receptors, with Council prior to any dispersal. Detailed advice and guidance on noise regulation can be found in the EPA's Noise guide for local government (EPA 2013).

Crown Lands Act 1989

The principles of Crown land management include the observance of environmental protection principles and the conservation of its natural resources, including water, soil, flora, fauna and scenic quality. Any works on land that is held or reserved under the Crown Lands Act 1989 (including vegetation management and dispersal activities) are an offence under the Act without prior authorisation obtained through the Department of Primary Industries (Lands).

Local Government Act 1993

The primary purpose of this Act is to provide the legal framework for an effective, efficient and environmentally responsible, open system of local government. Most relevant to flying-fox management is that it also provides encouragement for the effective participation of local communities in the affairs of local government and sets out guidance on the use and management of community land which may be applicable to land which requires management of flying-foxes.

State Environmental Planning Policies

SEPPs are environmental planning instruments which address specific planning issues within NSW. These SEPPs often remove power from local councils in order to control specific types of development or development in specific areas. SEPPs often transfer decision-making from Council to the Planning Minister. While there may be others, some of the SEPPs likely to apply at some flying-fox camps are outlined below.

Coastal SEPP

The new Coastal SEPP essential repeals and incorporates the elements of SEPP 14 Coastal Wetlands and SEPP 26 Littoral Rainforests.

This new policy maintains protection for coastal wetlands by requiring development consent to be obtained before any clearing, draining, filling or construction of levees can occur on a mapped wetland. Camps are unlikely to fall within the bounds of a Coastal Wetlands, but additional restrictions for vegetation management in these areas may be required if they do.

This policy maintains protection for coastal rainforests (littoral rainforests) by requiring development consent for activities within or adjacent to mapped coastal rainforest. It is unlikely that clearing for flying-fox management would be considered significant enough to trigger this SEPP but this should be confirmed if the site is within a mapped littoral rainforest area.

Commonwealth Legislation

Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides protection for the environment, specifically matters of national environmental significance (MNES). A referral to the Commonwealth DoE is required under the EPBC Act for any action that is likely to significantly impact on an MNES.

MNES under the EPBC Act that relate to flying-foxes include:

- world heritage sites (where those sites contain flying-fox camps or foraging habitat)
- wetlands of international importance (where those wetlands contain flying-fox camps or foraging habitat)
- nationally threatened species and ecological communities.

The grey-headed flying-fox (*Pteropus poliocephalus*; GHFF) is listed as a vulnerable species under the EPBC Act, meaning it is an MNES. It is also considered to have a single national population. DoE has developed the Referral guideline for management actions in GHFF and SFF[6] camps (DoE 2015) (the Guideline) to guide whether referral is required for actions pertaining to the GHFF.

The Guideline defines a nationally important GHFF camp as one that has either:

- contained ≥10,000 GHFF in more than one year in the last 10 years, or
- been occupied by more than 2500 GHFF permanently or seasonally every year for the last 10 years.

Provided that management at nationally important camps follows the mitigation standards below, DoE has determined that a significant impact to the population is unlikely, and referral is not likely to be required.

Referral will be required if a significant impact to any other MNES is considered likely as a result of management actions outlined in the Plan. Self-assessable criteria are available in the Significant Impact Guidelines 1.1 (DoE 2013) to assist in determining whether a significant impact is likely; otherwise consultation with DoE will be required.

Mitigation standards

- The action must not occur if the camp contains females that are in the late stages of pregnancy or have dependent young that cannot fly on their own.
- The action must not occur during or immediately after climatic extremes (heat stress event7, cyclone event8), or during a period of significant food stress9.
- Disturbance must be carried out using non-lethal means, such as acoustic, visual and/or physical disturbance or use of smoke.
- Disturbance activities must be limited to a maximum of 2.5 hours in any 12 hour period, preferably at or before sunrise or at sunset.
- Trees are not felled, lopped or have large branches removed when flying-foxes are in or near to a tree and likely to be harmed.
- The action must be supervised by a person with knowledge and experience relevant to the management of flying-foxes and their habitat, who can identify dependent young and is aware of climatic extremes and food stress events. This person must make an assessment of the

[6] spectacled flying-fox (*P. conspicillatus*)

[7] A 'heat stress event' is defined for the purposes of the Australian Government's Referral guideline for management actions in GHFF and SFF camps as a day on which the maximum temperature does (or is predicted to) meet or exceed 38°C.

[8] A 'cyclone event' is defined as a cyclone that is identified by the Australian Bureau of Meteorology (www.bom.gov.au/cyclone/index.shtml).

[9] Food stress events may be apparent if large numbers of low body weight animals are being reported by Wildlife Rehabilitators in the region.

relevant conditions and advise the proponent whether the activity can go ahead consistent with these standards.

Appendix 5 Media Coverage

During the past 5 years, local media outlets have run a number of stories regarding Flying-foxes throughout the Hunter Region, details of these up until mid 2016 are provided in the following table.

Media stories on Flying-foxes in the Hunter Region

Date	Media Source	Topic
11 August 2014	NBN Newcastle Hunter	Presented by Natasha Beyersdorf & Paul Lobb: “Wildlife Rehabilitators say around six flying-foxes are being killed or seriously injured each day in the Hunter region, after getting caught in fruit tree nets.
December 2014	The Maitland Mercury	“Bats invade central Maitland – video poll”
December 2014	The Maitland Mercury	“Bat problem needs ethical solution – editorial”
15 December 2014	Local land services newsletter	A Hunter LLS project to create new habitat for Grey-headed flying foxes is currently underway in the Lower Hunter. With a declining population, these mammals are listed as 'vulnerable' to extinction both in NSW and federally.
11 March 2015	Maitland Mercury	“It’s Cessnock’s turn to go batty”
13 March 2015	The Herald	”Cessnock residents in a flap as flying-fox colony returns”.
9 March 2015	NBN News	Newcastle (March7th):”A colony of flying-foxes is causing problems for Muswellbrook residents. Council has made a move to write to the NSW Government following noise and odour complaints”.
14 May 2015	NBN Newcastle Hunter, Newcastle	Vets in the Hunter region are urging horse owners to vaccinate them against Hendra Virus
21 May 2015	Newcastle Herald	Flying-foxes fill sky with confusion.
15 October 2015	ABC Upper Hunter	NSW MP for the Upper Hunter has called for state and federal government regulations about the removal of flying-fox colonies to be streamlined.
16 October 2015	Newcastle Herald	Bat plague solution needs red tape removed: MP
16 November 2015	Maitland Mercury	Eight Hunter New England bat attacks prompt health warning for Hunter Residents
17 November 2015	Maitland Mercury	Doctor warns of bat bites and scratches
25 November 2015	Cessnock Advertiser	Bat attacks prompt health warning for Hunter residents
10 February 2016	Cessnock Advertiser	Noisy neighbours driving residents batty
10 February 2016	Cessnock Advertiser	Risk of being attacked is extremely low, says vet
11 February 2016	Maitland Mercury	Hunter MP takes Maitland bat problem to Parliament

Date	Media Source	Topic
12 February 2016	Maitland Mercury	Residents welcome call to fix bat problem
23 February 2016	Sydney Morning Herald	Bats' 'super immunity' could help humans fight deadly diseases
23 March 2016	Singleton Argus	Joel Fitzgibbon: let's solve the bat problem once and for all
23 March 2016	Newcastle Herald	Fitzgibbon wants bat inquiry
23 March 2016	Maitland Mercury	No easy solution for Hunter's bat problem
15 March 2016	Cessnock Advertiser	Under Siege by Flying Foxes
15 March 2016:	Cessnock Advertiser	Muswellbrook residents plagued by flying foxes
16 March 2016	2NM Radio Muswellbrook	Joel Fitzgibbon, Hunter MP, will ask the Senate to initiate an inquiry into the flying-fox woes in Singleton, Cessnock, and other communities within the Hunter.
31 May 2016:	Newcastle Herald	Cessnock Council receives $10,000 for flying fox camp management plan
3 April 2016:	Newcastle Herald	EDITORIAL: What to do with the Hunter's troublesome flying fox colonies
8 April 2016:	Maitland Mercury	Call to action on bat situation
8 April 2016:	Newcastle Herald	Support growing for inquiry into management of flying foxes
11 April 2016:	Maitland Mercury	Support for bat inquiry
12 April 2016:	ABC Newcastle & ABC Upper Hunter	Flying fox expert says Hunter community should not waste money trying to move bats.
20 April 2016:	NBN Newcastle	A motion calling for a Senate inquiry has been lodged on behalf of Hunter MP Joel Fitzgibbon over the Hunter's flying fox population
20 April 2016:	ABC Newcastle	Interview with Joel Fitzgibbon, Member for Hunter, to discuss calling for a senate inquiry
20 April 2016	2NM Muswellbrook	Hunter MP Joel Fitzgibbon had his motion for the establishment of a Senate inquiry into the flying fox problem of the Hunter region moved into the Senate
20 April 2016:	ABC Newcastle	Interview with Joel Fitzgibbon, Member for Hunter, to discuss calling for a senate inquiry
22 April 2016	Maitland Mercury	Hunter bat infestations, Joel Fitzgibbon campaign
22 April 2016	Maitland Mercury	Girl steps on bat skull at park
27 April 2016	Cessnock Advertiser	Bat skull found in park

Date	Media Source	Topic
27 April 2016	Cessnock Advertiser	Senate inquiry motion lodged
26 May 2016	ABC Newcastle	Interview with Bob Pynsent, Mayor, Cessnock.
27 May 2016	Maitland Mercury	Councillor wants laws altered
27 May 2016:	The Conversation	Not in my backyard? How to live alongside flying-foxes in urban Australia
25 May 2016:	Maitland Mercury	Hunter bat problem no excuse to set fire to trees
24 May 2016	2HD Radio	Interview with Mark Speakman, NSW Environment Minister
24 May 2016:	ABC Online	Hunter communities left waiting as flying fox funding flies south
23 May 2016	KO FM, Newcastle	Muswellbrook residents fed up with flying foxes
23 May 2016:	Newcastle Herald	Hunter bat plague: Mike Baird announces $2.5 million for Batemans Bay but zilch for the Hunter
18 May 2016	Newcastle Herald	Call to extend bat plan to Hunter councils
22 May 2016:	Maitland Mercury	Hunter bat plague: firefighters extinguish suspicious blaze at Cessnock bat camp
6 June 2016:	Newcastle Herald	Hunter bat problem: Cessnock mayor lashes state government over funding, unanswered questions about population movements
27 June 2016	Maitland Mercury	Time to make noise over bats

Appendix 6 Survey Responses

The responses received from Flying-fox Engage are summarized in Section 3. Details of the actual responses are included below (responses have been sanitized where necessary).

Question	Responses
If you want to, you can comment on the flying-fox camp management options we have explored or you can suggest other solutions.	• Cull them . • complete removal / culling of the flying foxes needs to be placed as a top priority in the management plan - not left out!! • The use of frequency generators to produce very high frequencies that would disturb the flying foxes. Or move some of the councillors into the areas where the camp is then we may get something concrete done!!! • active manage actions are required, not level 1 type options. The Adelaide St camps are relatively recent in tome, well after Ross Wallbridge Reserve was established in marsh land. The camps have no historical basis and they sim p • Stop clearing their native habitat for development so they can stay in these areas and not require this initiative • We need to generate more vegetation areas so these flying foxes can live. • Relocation them • Active dispersal of a flying-fox camp using disturbance. I believe this should occur, and quickly! • Cut trees down clean up park and make it a fun safe environment for families • Creation of additional camps while maintaining the importance of the camp in Raymond Terrace is critical. There overpopulation of camps is one of the major attractors of "ire" at the flying-foxes, and additional options for their roosting place is necessary to help relieve the "load" on the current camp. Further education and increasing public knowledge about the critical role these animals play is also very important, as many people simply see them as pests and not as necessary. Protection of the animals is the most important aspect to be considered. • I live in Alton Road but too far away to be affected by the camp. • I knew a Venturer Scout leader who now has a 30% lung capacity after contracting a disease from dried bat poo. So if the climate continues to heat to the extent that the very dry & windy summers come on, then this may became a public health issue.is no • You need to work out what trees they are roosting in and clear them out. There has to be a safe way to move them on. There are plenty of other areas where there are no residents or businesses for them to have the impact they have on us • Just get on with the process of moving the flying foxes on to a new non residential area or start providing active practical help to those residents being directly impacted (noise, odour, mess, destruction of property). • It seemed to me that the ranking of the preferred management options initially offered represented council's preferences rather than those my responses to the survey indicated. I rearranged them accordingly. • Educate people on how important they are to the environment, and about how low the chance of infection or disease is. • They are a huge problem for Raymond Terrace.; these vermin are full of disease carrying viruses deadly to our population and pets. • When the camp is large the flying foxes are extremely noisy at night affecting sleep, they invade my fruit trees in summer making it

	impossible to get a crop, and often make a mess which has to be cleaned up when they fly over at dusk. It is extremely unpleasant being outside at dusk. This comes from a camp existing in the midst of a community. I'm not sure whether we should be a little more aggressive in the relocation option for both humans and flying foxes benefits. • Culling is not an option. Such an intelligent ecologically important animal is endangered! • First priority is to protect the flying foxes. Do no harm to flying foxes • I realise some intervention may be necessary to appease residents but generally the numbers will increase and decrease depending on external factors which are out of Council's control. I realise Council needs to be seen to be proactive but as other areas have shown, intervention has limited success and sooner or later the flying foxes may move off of their own accord. • In my experience, sprinklers in trees used constantly assisted with daily water hose treatment moved a large colony of foxes at Mataranka when the resort was threatened with economic ruin. This solution worked until management were forced to cease under pressure from green groups who obviously had no personal connection to the resort.
If you want to, please provide comments about this flying-fox camp	• Cull them , they appeared , a former resident told me , because of the council planted trees . • The flying foxes fly over our house morning and night. We have constant sticky, tarry droppings on the paths, cloths-line, cars, house roof and walls and even on the hand-rail at the front steps. Incredible smell prevents us from opening windows a lot of the time. • Disgusting odour especially when it rains - cannot open windows day or night in house - yard covered in flying fox faeces - outdoor area rood covered in faeces - cannot even let grandchildren play in the yard due to continual droppings - always hosing and cleaning property to rid of droppings - plants covered in droppings - even have visitors not calling in anymore due to the concerns of the droppings and odour - our whole lifestyle has changed - no longer do we have BBQ's outside. Property devalued - with all the publicity everyone knows not to buy in our street. so cant move stuck with the property • The councillors sat on its hands in the early stages of the camp when they might have been able to do something • Please leave them alone I enjoy watching them • As above, this camp was not historically present in this area, and the flying foxes simply colonised the man made recreational area to the detriment of all people living, working or visiting the area. If the law does not allow forced removal of these animals, the law must be changed. • I sometimes have 2-3 Bats in my front yard. When my Guava and Fig tree and fruiting they come to eat them. It does not both me. • Its VERY unpleasant to eat at nearby McDonalds because of the smell from the bats and driving past the area also is unpleasant. Not good for tourists by passing through Raymond Terrace to use eateries and shopping centre • They don't particularly bother me but I have smelled them at times and I think if my home was closer to the camp they would definitely be an issue. • Leave it alone • It smells • The camp seems too large for the vegetation. The planting of more habitable areas is needed.

	• Need to try to relocate to less populated area. Feel sorry for residents directly around the flying fox camp. Couldn't imagine MacDonald's would want camp so close to there business. • Numbers have increased dramatically in recent years with the adjacent areas being affected more & more. Something really needs to be done to reduce the size of the colony or relocate further out of town. I am now experiencing not being able to go outdoors for about a 4 hour period each night without being urinated on by passing / feeding flying foxes. My nieces have not been able to stay with me during the warmer months for quite some years as they are scared by the flying foxes. The Flying-fox camp is having a dramatic affects on nearby residents. • We have only lived here for 3 months and in this short time we have noticed that the Flying-fox Population has gotten bigger • they are loud late in the night and their poo ruins the paint on my house and car. • Don't like it want it gone • Like most neighbours I suffer the disgusting and sickening smell and the noise disturbances. Given that these animals arrived many years after I built my home, it is wrong that I have no rights in relation to this infestation. As a taxpayer/ratepayer, the authorities should, as a priority, put in place effective action remove these animals and stop them from flying over my home, yard and car. It is almost a daily occurrence for my car and the walls of my house (white) to be splattered by the ff's brown, sticky excrement. I cannot leave washing out on the line in the late afternoon because it too gets hit. In addition, on 3 occasions I have had to remove a potentially toxic, dead ff from my yard. In addition, each evening the ffs block TV transmission to my home; the flocks are so dense as they circle and pass over my home that they block digital TV transmission for about 15 - 20 minutes. • They are smelly and are not only a health risk, but see destroying the area • Its horrible smells and bat dropping on my car washing. I will no longer walk through park as its a health hazard • They fly over my house in the evening and crap on my car which is parked in my driveway. They also eat fruit in the trees behind my house and drop the seeds in my yard which if I don't pick up quick enough, my dogs eat. Surely that couldn't be healthy. • Yes their camp has an odour and a noise but humans get used to many adverse situations, and unless they are in your property, they won't hurt you. • The camp needs to be moved on at any cost. They are only getting worse and we shouldn't have to put up with them every year. They wake us up every morning when returning to camp and we can't go outside after dark as they are leaving the camp. I can no longer leave clothes on the line over night. They leave camp at around 6:30-7pm and return anywhere from 2-3am. Even if our house is all closed up we still hear them and the smell is horrific. • They are making us live like bats in a cave, cant open windows, cant go out and exercise, clothes & cars get marked from them • Management strategies need to be developed as soon as possible to cope with the bats in the area. The bats have only been in the Ross Wallbridge reserve for a few years, but the numbers each year are steadily growing. This growth is disturbing the park environment and the residents close by. The noise and smell during certain times of the year is hard to endure during warm weather when there is a need to close the house up to avoid the stench and noise.

	• The smell especially during or after rain is particularly objectionable • The camp has grown in numbers • the smell makes me sick and when they fly over my back yard they drop there droppings in my pool and on the stencil drive way which is very bard to remove. • Noise - disturbs sleep every single night and early morning on their return to roost; during the day they don't sleep, continual chatter. • Active management is necessary immediately to avoid a major problem like Cessnock. • Hate the bats they poo on my cars and they smell • I love the Flying Foxes and believe they are an important addition to the community. • Eradicate them before the problem becomes a epidemic • Noisy , smelly, excrement over cars/washing etc. • They stink, the smell is terrible, they are noisy and leave their droppings on my car, house, washing, and are just a pest. I am more concerned about our Koala population then those unwanted over numbered so called endangered/ protected bats. • It is a beautiful peaceful harmonious place. Love it. • It smells and has caused my family to stop using McDonalds restaurant.

Appendix 7 Management Options

Level 1 actions: routine camp management

Education and awareness programs

This management option involves undertaking a comprehensive and targeted flying-fox education and awareness program to provide accurate information to the local community about flying-foxes.

Such a program would include managing risk and alleviating concern about health and safety issues associated with flying-foxes, options available to reduce impacts from roosting and foraging flying-foxes, an up-to-date program of works being undertaken at the camp, and information about flying-fox numbers and flying-fox behaviour at the camp.

Residents should also be made aware that faecal drop and noise at night is mainly associated with plants that provide food, independent of camp location. Staged removal of foraging species such as fruit trees and palms from residential yards, or management of fruit (e.g. bagging, pruning) will greatly assist in mitigating this issue.

Collecting and providing information should always be the first response to community concerns in an attempt to alleviate issues without the need to actively manage flying-foxes or their habitat. Where it is determined that management is required, education should similarly be a key component of any approach. See also Section 3 and incorporate an education and awareness program into any community engagement plan.

An education program may include components shown in Figure 1.

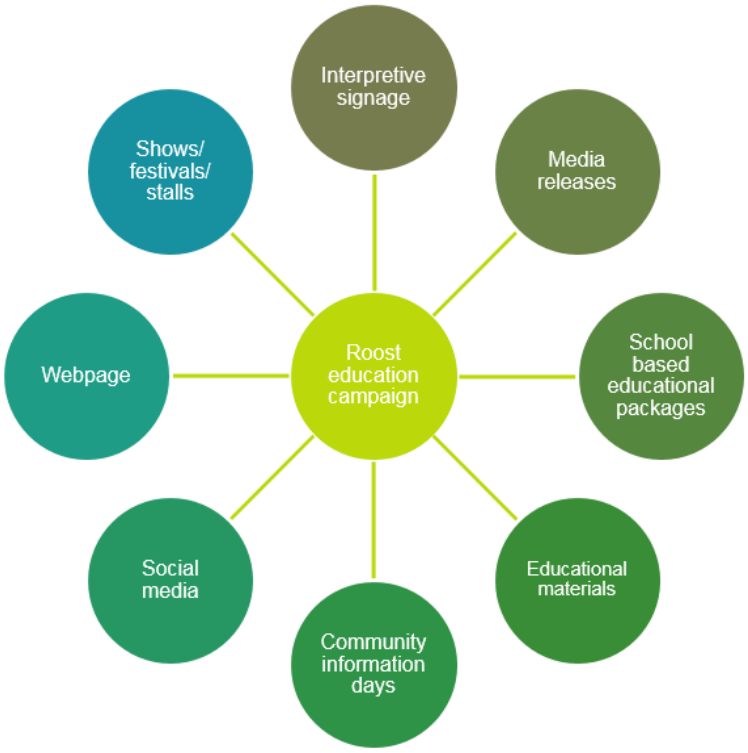


Figure 1: Possible components of an education program

The likelihood of improving community understanding of flying-fox issues is high. However, the extent to which that understanding will help alleviate conflict issues is probably less so. Extensive education for decision-makers, the media and the broader community may be required to overcome negative attitudes towards flying-foxes.

It should be stressed that a long-term solution to the issue resides with better understanding flying-fox ecology and applying that understanding to careful urban planning and development.

Property modification without subsidies

The managers of land on which a flying-fox camp is located would promote or encourage the adoption of certain actions on properties adjacent or near to the camp to minimise impacts from roosting and foraging flying-foxes (note that approval may be required for some activities, refer to Section 4 for further information):

- Create visual/sound/smell barriers with fencing or hedges. To avoid attracting flying-foxes, species selected for hedging should not produce edible fruit or nectar-exuding flowers, should grow in dense formation between two and five metres (Roberts 2006) (or be maintained at less than 5 metres). Vegetation that produces fragrant flowers can assist in masking camp odour where this is of concern.

- Manage foraging trees (i.e. plants that produce fruit/nectar-exuding flowers) within properties through pruning/covering with bags or wildlife friendly netting, early removal of fruit, or tree replacement.
- Cover vehicles, structures and clothes lines where faecal contamination is an issue, or remove washing from the line before dawn/dusk.
- Move or cover eating areas (e.g. BBQs and tables) within close proximity to a camp or foraging tree to avoid contamination by flying-foxes.
- Install double-glazed windows, insulation and use air-conditioners when needed to reduce noise disturbance and smell associated with a nearby camp.
- Follow horse husbandry and property management guidelines provided at the NSW Department of Primary Industries Hendra virus web page (DPI 2015a).
- Include suitable buffers and other provisions (e.g. covered car parks) in planning of new developments.
- Turn off lighting at night which may assist flying-fox navigation and increase fly-over impacts.
- Consider removable covers for swimming pools and ensure working filter and regular chlorine treatment.
- Appropriately manage rainwater tanks, including installing first-flush systems.
- Avoid disturbing flying-foxes during the day as this will increase camp noise.

The cost would be borne by the person or organisation who modifies the property; however, opportunities for funding assistance (e.g. environment grants) may be available for management activities that reduce the need to actively manage a camp.

Property modification subsidies

Fully funding or providing subsidies to property owners for property modifications may be considered to manage the impacts of the flying-foxes. Providing subsidies to install infrastructure may improve the value of the property, which may also offset concerns regarding perceived or actual property value or rental return losses.

The level and type of subsidy would need to be agreed to by the entity responsible for managing the flying-fox camp.

Service subsidies

This management option involves providing property owners with a subsidy to help manage impacts on the property and lifestyle of residents. The types of services that could be subsidised include clothes washing, cleaning outside areas and property, car washing or power bills. Rate reductions could also be considered.

Critical thresholds of flying-fox numbers at a camp and distance to a camp may be used to determine when subsidies would apply.

Routine camp maintenance and operational activities

Examples of routine camp management actions are provided in the Policy. These include:

- removal of tree limbs or whole trees that pose a genuine health and safety risk, as determined by a qualified arborist
- weed removal, including removal of noxious weeds under the Noxious Weeds Act 1993, or species listed as undesirable by a council
- trimming of understorey vegetation or the planting of vegetation
- minor habitat augmentation for the benefit of the roosting animals

- mowing of grass and similar grounds-keeping actions that will not create a major disturbance to roosting flying-foxes
- application of mulch or removal of leaf litter or other material on the ground.

Protocols should be developed for carrying out operations that may disturb flying-foxes, which can result in excess camp noise. Such protocols could include limiting the use of disturbing activities to certain days or certain times of day in the areas adjacent to the camp, and advising adjacent residents of activity days. Such activities could include lawn-mowing, using chainsaws, whipper-snippers, using generators and testing alarms or sirens.

Revegetation and land management to create alternative habitat

This management option involves revegetating and managing land to create alternative flying-fox roosting habitat through improving and extending existing low-conflict camps or developing new roosting habitat in areas away from human settlement.

Selecting new sites and attempting to attract flying-foxes to them has had limited success in the past, and ideally habitat at known camp sites would be dedicated as a flying-fox reserve. However, if a staged and long-term approach is used to make unsuitable current camps less attractive, whilst concurrently improving appropriate sites, it is a viable option (particularly for the transient and less selective LRFF). Supporting further research into flying-fox camp preferences may improve the potential to create new flying-fox habitat.

When improving a site for a designated flying-fox camp, preferred habitat characteristics detailed in Section 2 should be considered.

Foraging trees planted amongst and surrounding roost trees (excluding in/near horse paddocks) may help to attract flying-foxes to a desired site. They will also assist with reducing foraging impacts in residential areas. Consideration should be given to tree species that will provide year-round food, increasing the attractiveness of the designated site. Depending on the site, the potential negative impacts to a natural area will need to be considered if introducing non-indigenous plant species.

The presence of a water source is likely to increase the attractiveness of an alternative camp location. Supply of an artificial water source should be considered if unavailable naturally, however this may be cost-prohibitive.

Potential habitat mapping using camp preferences (see Section 2) and suitable land tenure can assist in initial alternative site selection. A feasibility study would then be required prior to site designation to assess likelihood of success and determine the warranted level of resource allocated to habitat improvement.

Provision of artificial roosting habitat

This management option involves constructing artificial structures to augment roosting habitat in current camp sites or to provide new roosting habitat. Trials using suspended ropes have been of limited success as flying-foxes only used the structures that were very close to the available natural roosting habitat. It is thought that the structure of the vegetation below and around the ropes is important.

Protocols to manage incidents

This management option involves implementing protocols for managing incidents or situations specific to particular camps. Such protocols may include ‘bat watch’ patrols at sites that host vulnerable people, management of pets at sites popular for walking dogs or heat stress incidents (when the camp is subjected to extremely high temperatures leading to flying-foxes changing their behaviour and/or dying).

Participation in research

This management option involves participating in research to improve knowledge of flying-fox ecology to address the large gaps in our knowledge about flying-fox habits and behaviours and why they choose certain sites for roosting. Further research and knowledge sharing at local, regional and national levels will enhance our understanding and management of flying-fox camps.

Appropriate land-use planning

Land-use planning instruments may be able to be used to ensure adequate distances are maintained between future residential developments and existing or historical flying-fox camps. While this management option will not assist in the resolution of existing land-use conflict, it may prevent issues for future residents.

Property acquisition

Property acquisition may be considered if negative impacts cannot be sufficiently mitigated using other measures. This option will clearly be extremely expensive, however is likely to be more effective than dispersal and in the long-term may be less costly.

Do nothing

The management option to ‘do nothing’ involves not undertaking any management actions in relation to the flying-fox camp and leaving the situation and site in its current state.

Level 2 actions: in-situ management

Buffers

Buffers can be created through vegetation removal and/or the installation of permanent/semi-permanent deterrents.

Creating buffers may involve planting low-growing or spiky plants between residents or other conflict areas and the flying-fox camp. Such plantings can create a visual buffer between the camp and residences or make areas of the camp inaccessible to humans.

Buffers greater than 300 metres are likely to be required to fully mitigate amenity impacts (SEQ Catchments 2012). The usefulness of a buffer to mitigate odour and noise impacts generally declines if the camp is within 50 metres of human habitation (SEQ Catchments 2012), however any buffer will assist and should be as wide as the site allows.

Buffers through vegetation removal

Vegetation removal aims to alter the area of the buffer habitat sufficiently so that it is no longer suitable as a camp. The amount required to be removed varies between sites and camps, ranging from some weed removal to removal of most of the canopy vegetation.

Any vegetation removal should be done using a staged approach, with the aim of removing as little native vegetation as possible. This is of particular importance at sites with other values (e.g. ecological or amenity), and in some instances the removal of any native vegetation will not be appropriate. Thorough site assessment (further to desktop searches, see Appendix 4) will inform whether vegetation management is suitable (e.g. can impacts to other wildlife and/or the community be avoided?).

Removing vegetation can also increase visibility into the camp and noise issues for neighbouring residents which may create further conflict.

Suitable experts (Appendix 1) should be consulted to assist selective vegetation trimming/removal to minimise vegetation loss and associated impacts.

The importance of under- and mid-storey vegetation in the buffer area for flying-foxes during heat stress events also requires consideration.

Buffers without vegetation removal

Permanent or semi-permanent deterrents can be used to make buffer areas unattractive to flying-foxes for roosting, without the need for vegetation removal. This is often an attractive option where vegetation has high ecological or amenity value.

While many deterrents have been trialled in the past with limited success, there are some options worthy of further investigation:

- Visual deterrents – Visual deterrents such as plastic bags, fluoro vests (GeoLINK 2012) and balloons (Ecosure 2016, pers. comm.) in roost trees have shown to have localised effects, with flying-foxes deterred from roosting within 1–10 metres of the deterrents. 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.
- Smell deterrents – For example, bagged python excrement hung in trees has previously had a localised effect (GeoLINK 2012). The smell of certain deterrents may also impact nearby residents, and there is potential for flying-foxes to habituate.
- Canopy-mounted water sprinklers – This method has been effective in deterring flying-foxes during dispersals (Ecosure personal experience), and a current trial in Queensland is showing promise for keeping flying-foxes out of designated buffer zones. This option can be logistically difficult (installation and water sourcing) and may be cost-prohibitive. Design and use of sprinklers need to be considerate of animal welfare and features of the site. For example, misting may increase humidity and exacerbate heat stress events, and overuse may impact other environmental values of the site.

Note that any deterrent with a high risk of causing inadvertent dispersal may be considered a Level 3 action.

The use of visual deterrents, in the absence of effective maintenance, could potentially lead to an increase in rubbish in the natural environment.

Noise attenuation fencing

Noise attenuation fencing could be installed in areas where the camp 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 could negate the need for habitat modification, maintaining the ecological values of the site, and may be more cost-effective than ongoing management.

Level 3 actions: disturbance or dispersal

Nudging

Noise and other low intensity active disturbance restricted to certain areas of the camp can be used to encourage flying-foxes away from high conflict areas. This technique aims to actively ‘nudge’ flying-foxes from one area to another, while allowing them to remain at the camp site.

Unless the area of the camp is very large, nudging should not be done early in the morning as this may lead to inadvertent dispersal of flying-foxes from the entire camp site. Disturbance during the day should be limited in frequency and duration (e.g. up to four times per day for up to 10 minutes each) to avoid welfare impacts. As with dispersal, it is also critical to avoid periods when dependent young are present (as identified by a flying-fox expert).

Dispersal

Dispersal aims to encourage a camp to move to another location, through either disturbance or habitat modification.

There is a range of potential risks, costs and legal implications that are greatly increased with dispersal (compared with in-situ management as above). See Appendix 6 for more details. These include:

- impact on animal welfare and flying-fox conservation
- splintering the camp into other locations that are equally or more problematic
- shifting the issue to another area
- impact on habitat value
- effects on the flying-fox population, including disease status and associated public health risk
- impacts to nearby residents associated with ongoing dispersal attempts
- excessive initial and/or ongoing capacity and financial investment
- negative public perception and backlash
- increased aircraft strike risk associated with changed flying-fox movement patterns
- unsuccessful management requiring multiple attempts, which may exacerbate all of the above.

Despite these risks, there are some situations where camp dispersal may be considered. Dispersal can broadly be categorised as ‘passive’ or ‘active’ as detailed below.

Passive dispersal

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 camp 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 2011). Ongoing maintenance of the site is required to prevent vegetation structure returning to levels favourable for colonisation by flying-foxes. Importantly, at nationally important camps (defined in Section 2) sufficient vegetation must be retained to accommodate the maximum number of flying-foxes recorded at the site.

This option may be preferable in situations where the vegetation is of relatively low ecological and amenity value, and alternative known permanent camps are located nearby with capacity to absorb the additional flying-foxes. While the likelihood of splinter colonies forming is lower than with active dispersal, if they do form following vegetation modification there will no longer be an option to encourage flying-foxes back to the original site. This must be carefully considered before modifying habitat.

There is also potential to make a camp site unattractive by removing access to water sources. However at the time of writing this method had not been trialled so the likelihood of this causing a camp to be abandoned is unknown. It would also likely only be effective where there are no alternative water sources in the vicinity of the camp.

Active dispersal through disturbance

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 preferably swapped regularly for alternate tools). 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 (e.g. wind direction for smoke drums).

Active dispersal will be disruptive for nearby residents given the timing and nature of activities, and this needs to be considered during planning and community consultation.

This method does not explicitly use habitat modification as a means to disperse the camp, however if dispersal is successful, some level of 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 the site, with options for modifying habitat the same as those detailed for buffers above.

Early dispersal before a camp is established at a new location

This management option involves monitoring local vegetation for signs of flying-foxes roosting in the daylight hours and then undertaking active or passive dispersal options to discourage the animals from establishing a new camp. Even though there may only be a few animals initially using the site, this option is still treated as a dispersal activity, however it may be simpler to achieve dispersal at these new sites than it would in an established camp. It may also avoid considerable issues and management effort required should the camp be allowed to establish in an inappropriate location.

It is important that flying-foxes feeding overnight in vegetation are not mistaken for animals establishing a camp.

Maintenance dispersal

Maintenance dispersal refers to active disturbance following a successful dispersal to prevent the camp from re-establishing. It differs from initial dispersal by aiming to discourage occasional over-flying individuals from returning, rather than attempting to actively disperse animals that have been recently roosting at the site. As such, maintenance dispersal may have fewer timing restrictions than initial dispersal, provided that appropriate mitigation measures are in place (see Appendix 8).

Unlawful activities

Culling

Culling is addressed here as it is often raised by community members as a preferred management method; however, culling is contrary to the objects of the BC Act and will not be permitted as a method to manage flying-fox camps.

Appendix 8 Management Guidelines

Stop work triggers

The management program will cease and will not recommence or progress to subsequent levels without consulting OEH if:

- any of the animal welfare triggers occur on more than two days during the program, such as unacceptable levels of stress (see Table 5)
- there is a flying-fox injury or death
- a new camp/camps appear to be establishing
- impacts are created or exacerbated at other locations
- there appears to be potential for conservation impacts (e.g. reduction in breeding success identified through independent monitoring)
- standard measures to avoid impacts cannot be met.

Management may also be terminated at any time if:

- unintended impacts are created for the community around the camp
- allocated resources are exhausted.

Dispersal will cease if:

- in the opinion of the land manager or OEH, there is ongoing proliferation of splinter colonies in unsuitable locations (as determined by the land manager or OEH)
- splinter camps become established in inappropriate locations and for ecological, social or other reasons, a dispersal at the splinter location is not appropriate (as determined by the land manager or OEH).

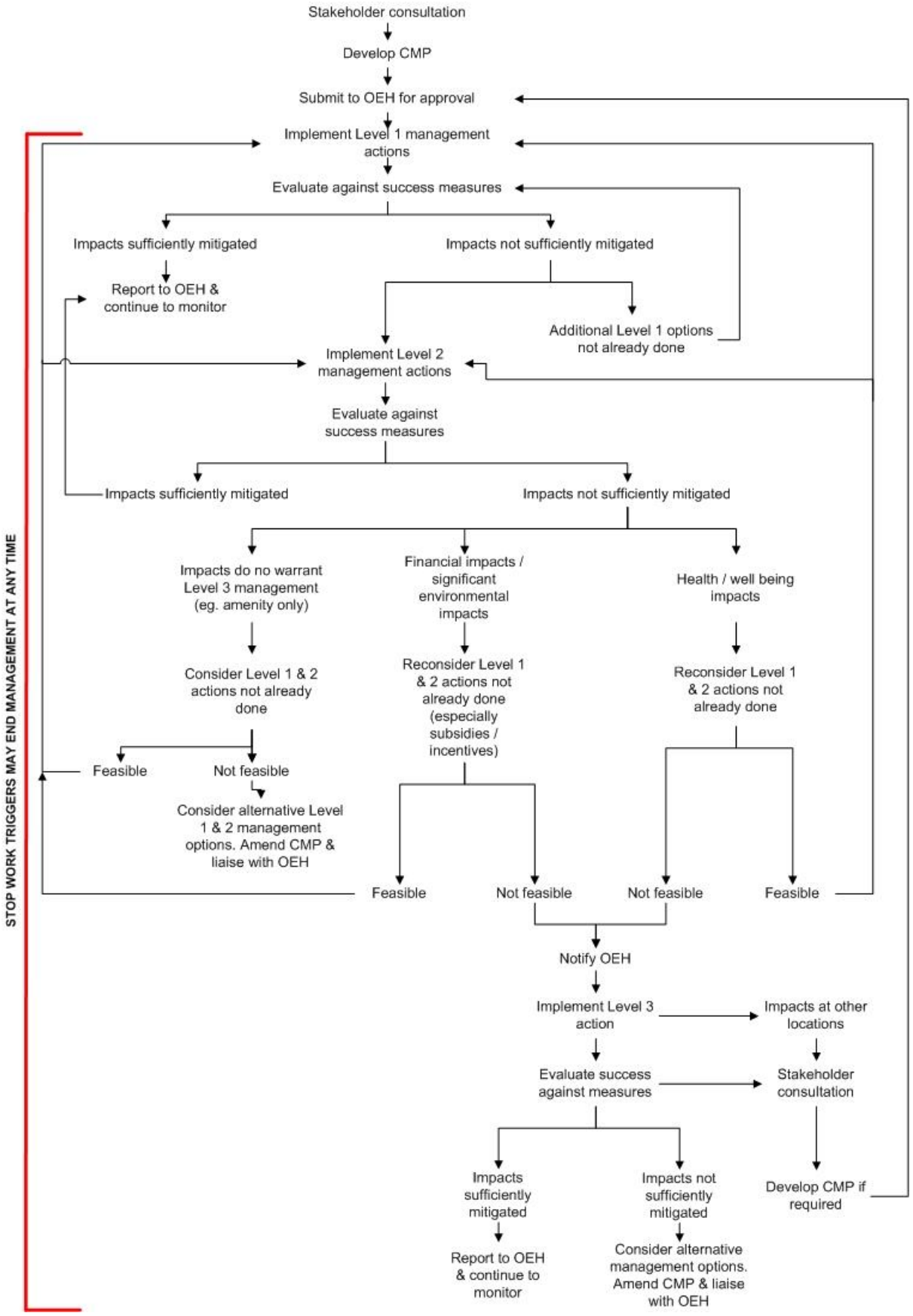
If a dispersal program is stopped it may be permanently abandoned and other strategies considered, or reassessed and resumed in consultation with OEH.

Planned action for potential impacts during management.

A person with experience in flying-fox behaviour will monitor for welfare triggers and direct works in accordance with the criteria below

Welfare trigger	Signs	Action
Unacceptable levels of stress	If any individual is observed: panting saliva spreading located on or within 2 m of the ground	Works to cease for the day.
Fatigue	In-situ management more than 30% of the camp takes flight individuals are in flight for more than 5 minutes flying-foxes appear to be leaving the camp Dispersal low flying laboured flight settling despite dispersal efforts	In-situ management Works to cease and recommence only when flying-foxes have settled* / move to alternative locations at least 50 m from roosting animals. Dispersal Works to cease for the day.
Injury/death	a flying-fox appears to have been injured/killed on site (including aborted foetuses) any flying-fox death is reported within 1 km of the dispersal site that appears to be related to the dispersal females in final trimester dependent/crèching young present loss of condition evident	Works to cease immediately and OEH 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 (see Appendix 1) OR stopped indefinitely and alternative management options investigated.

** maximum of two unsuccessful attempts to recommence work before ceasing for the day.*


Stakeholder consultation
Develop CMP
Submit to OEH for approval
Implement Level 1 management actions
Evaluate against success measures
Impacts sufficiently mitigated
Impacts not sufficiently mitigated
Report to OEH & continue to monitor
Additional Level 1 options not already done
Implement Level 2 management actions
Evaluate against success measures
Impacts sufficiently mitigated
Impacts not sufficiently mitigated
Impacts do no warrant Level 3 management (eg. amenity only)
Financial impacts / significant environmental impacts
Health / well being impacts
Consider Level 1 & 2 actions not already done
Reconsider Level 1 & 2 actions not already done (especially subsidies / incentives)
Reconsider Level 1 & 2 actions not already done
Feasible
Not feasible
Consider alternative Level 1 & 2 management options. Amend CMP & liaise with OEH
Feasible
Not feasible
Not feasible
Feasible
Notify OEH
Implement Level 3 action
Impacts at other locations
Evaluate success against measures
Stakeholder consultation
Impacts sufficiently mitigated
Impacts not sufficiently mitigated
Develop CMP if required
Report to OEH & continue to monitor
Consider alternative management options. Amend CMP & liaise with OEH
STOP WORK TRIGGERS MAY END MANAGEMENT AT ANY TIME

Standard Measures to Avoid Impacts

The following mitigation measures will be complied with at all times during Plan implementation.

All Management Activities

- All personnel will be appropriately experienced, trained and inducted. Induction will include each person's responsibilities under this Plan.
- All personnel will be briefed prior to the action commencing each day, and debriefed at the end of the day.
- Works will cease and OEH consulted in accordance with the 'stop work triggers' section of the Plan.
- Large crews will be avoided where possible.
- The use of loud machinery and equipment that produces sudden impacts/noise will be limited. Where loud equipment (e.g. chainsaws) is required they will be started away from the camp and allowed to run for a short time to allow flying-foxes to adjust.
- Activities that may disturb flying-foxes at any time during the year will begin as far from the camp as possible, working towards the camp gradually to allow flying-foxes to habituate.
- Any activity likely to disturb flying-foxes so that they take flight will be avoided during the day during the sensitive GHFF/BFF birthing period (i.e. when females are in final trimester or the majority are carrying pups, generally August – December) and avoided altogether during crèching (generally November/December to February). Where works cannot be done at night after fly-out during these periods, it is preferable they are undertaken in the late afternoon close to or at fly-out. If this is also not possible, a person experienced in flying-fox behaviour will monitor the camp for at least the first two scheduled actions (or as otherwise deemed to be required by that person) to ensure impacts are not excessive and advise on the most appropriate methods (e.g. required buffer distances, approach, etc.).
- OEH will be immediately contacted if LRFF are present between March and October, or are identified as being in final trimester / with dependent young.
- Non-critical maintenance activities will ideally be scheduled when the camp is naturally empty. Where this is not possible (e.g. at permanently occupied camps) they will be scheduled for the best period for that camp (e.g. when the camp is seasonally lower in numbers and breeding will not be interrupted, or during the non-breeding season, generally May to July).
- Works will not take place in periods of adverse weather including strong winds, sustained heavy rains, in very cold temperatures or during periods of likely population stress (e.g. food bottlenecks). Wildlife Rehabilitators will be consulted to determine whether the population appears to be under stress.
- Works will be postponed on days predicted to exceed 35°C (or ideally 30°C), and for one day following a day that reached ≥35°C. If an actual heat stress event has been recorded at the camp or at nearby camps, a rest period of several weeks will be scheduled to allow affected flying-foxes to fully recover. See the OEH fact sheet on Responding to heat stress in flying-fox camps.
- Evening works may commence after fly-out. Noise generated by the works should create a first stage disturbance, with any remaining flying-foxes taking flight. Works should be paused at this stage to monitor for any remaining flying-foxes (including crèching young, although December – February should be avoided for this reason) and ensure they will not be impacted. All Level 1 and 2 works (including pack up) will cease by 0100 to ensure flying-foxes returning early in the morning are not inadvertently dispersed. Works associated with Level 3 actions may continue provided flying-foxes are not at risk of being harmed.

- If impacts at other sites are considered, in OEH's opinion, to be a result of management actions under this Plan, assistance will be provided by the proponent to the relevant land manager to ameliorate impacts. Details of this assistance are to be developed in consultation with OEH.
- Any proposed variations to works detailed in the Plan will be approved, in writing, by OEH before any new works occur.
- OEH may require changes to methods or cessation of management activities at any time.
- Ensure management actions and results are recorded to inform future planning. See the OEH fact sheet on Monitoring, evaluating and reporting.

It is the responsibility of the land manager and contractors to conduct a risk assessment and determine workplace health and safety requirements; however, minimum requirements are provided following.

Human safety

- All personnel to wear protective clothing including long sleeves and pants; additional items such as eye protection and a hat are also recommended. People working under the camp should wash their clothes daily. Appropriate hygiene practices will be adopted such as washing hands with soap and water before eating/smoking.
- All personnel who may come into contact with flying-foxes will be vaccinated against Australian bat lyssavirus with current titre.
- A wash station will be available on site during works along with an anti-viral antiseptic (e.g. Betadine) should someone be bitten or scratched.
- Details of the nearest hospital or doctor who can provide post-exposure prophylaxis will be kept on site.

Post-works

- Reports for Level 1 actions will be provided to OEH annually. Reports for Level 2 and 3 actions will be submitted to OEH one month after commencement of works and then quarterly for the life of the Plan (up to five years) (for all Level 3 actions and in periods where works have occurred for Level 2 actions). Each report is to include:
    - results of pre- and post-work population monitoring
    - any information on new camps that have formed in the area
    - impacts at other locations that may have resulted from management, and suggested amelioration measures
    - an assessment of how the flying-foxes reacted to the works, with particular detail on the most extreme response and average response, outlining any recommendations for what aspects of the works went well and what aspects did not work well
    - further management actions planned including a schedule of works
    - an assessment of how the community responded to the works, including details on the number and nature of complaints before and after the works
    - detail on any compensatory plantings undertaken or required
    - expenditure (financial and in-kind costs)
    - Plan evaluation and review (see Section 12).

All Level 2 and 3 Actions

Prior to works

- Residents adjacent to the camp will be individually notified one week prior to on-ground works commencing. This will include information on what to do if an injured or orphaned flying-fox is

observed, a reminder not to participate in or interfere with the program, and details on how to report unusual flying-fox behaviour/daytime sightings. Relevant contact details will be provided (e.g. Program Coordinator). Resident requests for retention of vegetation and other concerns relating to the program will be taken into consideration.

- Where the Plan is being implemented by Council, information will be placed on Council's website along with contact information.
- OEH will be notified at least 48 hours before works commence.
- A protocol, in accordance with the NSW Code of Practice for Injured, Sick and Orphaned Flying-foxes (OEH 2012), for flying-fox rescue will be developed including contact details of rescue and rehabilitation organisations. This protocol will be made available to all relevant staff, residents and volunteers prior to the action commencing. See Appendix 8 for an example protocol.
- A licensed wildlife carer will be notified prior to beginning works in the event that rescue/care is required.
- Monitoring
- A flying-fox expert (identified in section 13.3) will undertake an on-site population assessment prior to, during works and after works have been completed, including:
    - number of each species
    - ratio of females in final trimester
    - approximate age of any pups present including whether they are attached or likely to be crèched
    - visual health assessment
    - mortalities.
- Counts will be done at least:
    - once immediately prior to works
    - daily during works
    - immediately following completion
    - one month following completion
    - 12 months following completion.

During works

- A flying-fox expert (identified in section 13.3) will attend the site as often as OEH considers necessary to monitor flying-fox behaviour and ensure compliance with the Plan and the Policy. They must also be able to identify pregnant females, flightless young, individuals in poor health and be aware of climatic extremes and food stress events. This person will make an assessment of the relevant conditions and advise the supervisor/proponent whether the activity can go ahead.
- Deterrents in buffer areas will be assessed by a flying-fox expert so those that may cause inadvertent dispersal (e.g. canopy-mounted sprinklers) are not used during fly-in.
- At least one flying-fox rest day with no active management will be scheduled fortnightly, preferably weekly. Static deterrents (e.g. canopy-mounted sprinklers) may still be used on rest days.

Vegetation Trimming / Removal

- Dead wood and hollows will be retained on site where possible as habitat.
- Vegetation chipping is to be undertaken as far away from roosting flying-foxes as possible (at least 100 metres).

Canopy Vegetation Trimming / Removal

Prior to works

- Trees to be removed or lopped will be clearly marked (e.g. with flagging tape) prior to works commencing, to avoid unintentionally impacting trees to be retained.

During works

- Any tree lopping, trimming or removal is undertaken under the supervision of a suitably qualified arborist (minimum qualification of Certificate III in Horticulture (Arboriculture) who is a member of an appropriate professional body such as the National Arborists Association).
- Trimming will be in accordance with relevant Australian Standards (e.g. AS4373 Pruning of Amenity Trees), and best practice techniques used to remove vegetation in a way that avoids impacting other fauna and remaining habitat.
- No tree in which a flying-fox is roosting will be trimmed or removed. Works may continue in trees adjacent to roost trees only where a person experienced in flying-fox behaviour assesses that no flying-foxes are at risk of being harmed. A person experienced in flying-fox behaviour is to remain on site to monitor, when canopy trimming/removal is required within 50 metres of roosting flying-foxes.
- While most females are likely to be carrying young (generally September – January) vegetation removal within 50 metres of the camp will only be done in the evening after fly-out, unless otherwise advised by a flying-fox expert.
- Tree removal as part of management will be offset at a ratio of at least 2:1. Where threatened vegetation removal is required, the land manager will prepare an Offset Strategy to outline a program of restoration works in other locations (in addition to existing programs). The strategy will be submitted to OEH for approval at least two months prior to commencing works.

Bush Regeneration

- All works will be carried out by suitably qualified and experienced bush regenerators, with at least one supervisor knowledgeable about flying-fox habitat requirements (and how to retain them for Level 1 and 2 actions) and trained in working under a camp.
- Vegetation modification, including weed removal, will not alter the conditions of the site such that it becomes unsuitable flying-fox habitat for Level 1 and 2 actions.
- Weed removal should follow a mosaic pattern, maintaining refuges in the mid- and lower storeys at all times.
- Weed control in the core habitat area will be undertaken using hand tools only (or in the evening after fly-out while crèching young are not present).
- Species selected for revegetation will be consistent with the habitat on site, and in buffer areas or conflict areas should be restricted to small shrubs/understorey species to reduce the need for further roost tree management in the future