68-80 O'Connell Street, Kingswood – Fauna Management Plan

Caddens Estate Development Pty Ltd

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DOCUMENT TRACKING

Project Name	68-80 O'Connell Street, Kingswood - Vegetation Management Plan
Project Number	22SYD-2193
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Status	**Final**
Version Number	**1**
Last saved on	**28 February 2024**

This report should be cited as 'Eco Logical Australia 2024. *68-80 O'Connell Street, Kingswood – Fauna Management Plan*. Prepared for Caddens Estate Development Pty Ltd.'

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from Caddens Estate Development Pty Ltd

Template 2.8.1

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Abbreviations

Abbreviation	Description
BC Act	Biodiversity Conservation Act (2016)
BDAR	Biodiversity Development Assessment Report
EGK	Eastern Grey Kangaroo
ELA	Ecological Australia
NSW	New South Wales
VMP	Vegetated Management Plan
WSU	Western Sydney University

1. Introduction

This Fauna Management Plan (FMP) has been prepared by Eco Logical Australia (ELA) on behalf of Caddens Estate Development Pty Ltd for the proposed residential development at 68-80 O'Connell Street, Kingswood (partial Lot 1 and 2 DP1268507) in Penrith Local Government Area (LGA). It provides management plans for fauna species on site heavily focused on Eastern Grey Kangaroos (EGK)

1.1. Background and context

The subject site is located within the suburb of Caddens, Sydney between Western Sydney University Kingswood to the east and Caddens Corner shopping centre to the west (Figure 1). Part of the area proposed for development falls within the same lot as the existing Caddens Corner Shopping Centre (Lot 1 DP1268507). Caddens Estate Development Pty Ltd proposed to submit a Development Application (DA) under Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act) for the staged construction of a mixed-use re-development. The works will involve the construction of 18 buildings, 469 residential apartments, 4 commercial premises, basement car parking & associated demolition, tree-removal, subdivision including boundary adjustment and public roads, earthworks, landscaping and stormwater drainage works.

Penrith City Council provided a 'Request for Information' on 7 November 2023 to provide feedback to Caddens Estate Development Pty Ltd's response to the initial RFI Council letter dated 2 August 2023. This RFI noted that a Fauna Management Plan (FMP) must be included in the Development Application Submission outlining the following:

- *The site contains grazing habitat for a resident population of Kangaroos and also contains hollow bearing trees. A Fauna Management Plan or referred to as Biodiversity Management Plan should be prepared that will outline how impacts to fauna as a result of the development will be avoided and minimised. This will include addressing or creating a protocol of how to address scenarios when Kangaroos are present or access the development site, pre-clearance survey and supervision of the removal of habitat trees.*
- *Significant community concern has been raised in relation to the proposed development's impact on the kangaroo population.*
- *It is recommended that the applicant liaises with the University of Western Sydney to coordinate arrangements for the management of the kangaroo population.*
- *Any proposed Kangaroo management must be informed by research, data and specialised knowledge.*

Figure 1 Location Map

1.2. Biology and ecology of Eastern grey kangaroos

The EGK is common across eastern Australia (Queensland, New South Wales, Victoria and eastern South Australia), being a highly generalist species. They are one of the largest macropods (family *Macropodiformes*), with large sexual dimorphism (females: 20 – 40kg, ~1m body length, ~0.8m tail length; males: 50 – 70kg, ~1.3m body length, ~0.8m tail length). EGK are the largest macropod east of the Great Dividing Range (GDR), with the closely related Western Grey Kangaroo (*M. fuliginosus*) overlapping with the EGK range west of the GDR. The EGK occurs in mobs which vary significantly in size (typically 4 – 50 individuals; Southwell 1984), with a fission–fusion social structure (*i.e.*, mobs will join and split over time) (Best et al. 2014). As such, home ranges (around 12 – 40ha in size) overlap significantly with no evidence of territoriality of habitat. However, EGK maintain social hierarchies, particularly among males, with heavier, larger males dominating mating (Miller et al. 2010).

EGK fluctuate in reproductive success greatly between seasons, influenced by both 'bottom-up' (resource availability) and 'top-down' (predation pressure) process (Robertson 1986; Banks et al. 2000; Pople et al. 2010b; Letnic and Crowther 2013). When conditions are optimal, EGK can breed rapidly, due to several key adaptations: 1) being able to reproduce at any time of the year (though this mostly occurs in late spring and summer); 2) a longer than average gestation period compared with other marsupials, resulting in more developed with a higher survival rate; and 3) capabilities for post-partum oestrus, whereby conception can occur immediately after birth, with the newly conceived embryo entering diapause once it reaches the blastocyst stage (Poole and Catling 1974, Poole 1983, Herbert et al. 2006). These characteristics allow for EGK to have multiple young in succession, with embryonic diapause allowing for rapid increases in population size during optimal conditions (Renfree and Shaw 2000). EGK young are born in a highly altricial state but will remain in the pouch for ~240 – 330 days, resulting in highly developed young upon emergence. Following emergence from the pouch, young will continue to rely on the mother for nutrition and can be weaned when conditions provide for adequate feed (but generally around 18 months of age; Poole 1975). Reproduction will commence at around 18 months in females and around 4 years in males (Poole and Catling 1974), with male-only dispersal from the natal home range at around 1 – 2 years after weaning (Russell 1989).

EGK can occur across a wide range of habitat types, but prefer *Eucalyptus* dominated canopy communities, with dense lateral cover and moderate grass cover (Hill 1981). They are a generalist herbivore, grazing preferentially in grassy woodland habitats (Schmidt et al. 2010) primarily at dawn (up to 2 – 3 hrs after sunrise) and dusk (4 hrs before sunset and 2 – 3 hours after sunset) (displaying crepuscular traits, Kaufmann 1975); though in hot conditions, EGK almost exclusively feed at night (McCullough and McCullough 2000). EGK will spend the remainder of the day sheltering under trees and scrub (Woodward et al. 2006).

1.3. Legislative context

Both in New South Wales, and across Australia, EGK are considered common and secure (listed as of 'least concern' under the International Union for Conservation of Nature). In NSW, kangaroos are protected and cannot be harmed under the Biodiversity Conservation (BC) Act 2016 (Part 2, Division 1 – 2.1).

1.4. Scope and objective

The overall objective of the FMP is to provide a management plan to assist in reducing impacts on all fauna, with a focus on the resident population of Eastern Grey Kangaroos currently located across the subject site and adjacent University of Western Sydney Land (WSU). The objectives of this management plan will outline how impacts to fauna will be avoided or minimised where possible through the following tasks:

- Surveys for fauna prior to construction works commencing.
- Recommendations for replacement habitat features
- Pre-clearance surveys and supervision of habitat tree removal
- Kangaroo specific surveys on the current population on, and their utilisation of, the subject land
- Suggestions on future management options for Kangaroos on the subject site
- Fencing suggestions to eliminate the use of the land by Kangaroos during the construction period.

Suggestions to co-ordinate and liaise with University of Western Sydney in relation to the management of the kangaroo population will also form part of the scope as this proposed development will reduce the usable space available for the kangaroos by approximately 3.93 Hectares.

2. Methodology

2.1. Kangaroo literature review

Prior to field surveys, relevant scientific literature and management documentation were reviewed, including (but not isolated to):

- AgriFutures Australia (2020) National Code of Practice for the Humane Shooting of Kangaroos and Wallabies for Commercial Purposes
- Australian Capital Territory Government (2017) Eastern Grey Kangaroo: Controlled Native Species Management Plan 2017. Natural Conservation Act 2014
- Biodiversity Conservation Act (2016)
- Bionet NSW Office of Environment and Heritage (2021) BioNet Atlas. Data accessed 27/01/2024.
- Descovich, K., Tribe, A., McDonald, I.J. and Phillips, C.J. (2016). The eastern grey kangaroo: current management and future directions. *Wildlife Research*, *43*(7): 576-589
- NSW Office of Environment and Heritage (2016). NSW Commercial Kangaroo Harvest Management Plan 2017 – 2021
- Victoria Department of Environment, Land, Water and Planning (2021). Victorian Kangaroo Harvest Management Plan 2021 – 2023
- Victoria Department of Environment, Land, Water and Planning, (2015) Guide to preparing a kangaroo management plan for Melbourne's growth corridors

2.2. Kangaroo population counts and behaviour observations.

Counts and behavioural observations of EGK on the subject site, located 68-80 O'Connell Street, Kingswood, were made on two mornings (within the first two hours after sunrise) and on two evenings (within the last two hours before sunset). Counts were undertaken by traversing the site on foot and counting all visible EGK. The Western Sydney University land adjacent to the site was not accessible during the survey and any EGK on WSU land were observed and counted from the subject site land or O'Connell Street, Caddens. The results of the Kangaroo population count can be found in Table 1. The results show that a similar number of EGK are observed in the morning and the evening within the subject site or within close proximity to the subject site.

The behavioural observations of the EGK during these times would suggest that the EGK disperse from the subject site into the WSU land throughout the day and return in the evenings to the vegetated area within the site boundary which is the proposed Vegetation Management Plan (VMP) area (ELA 2024). Two large males were observed sparring but no signs of aggression were observed from any of the EGK suggesting there is not currently any competition for food or space within the population observed.

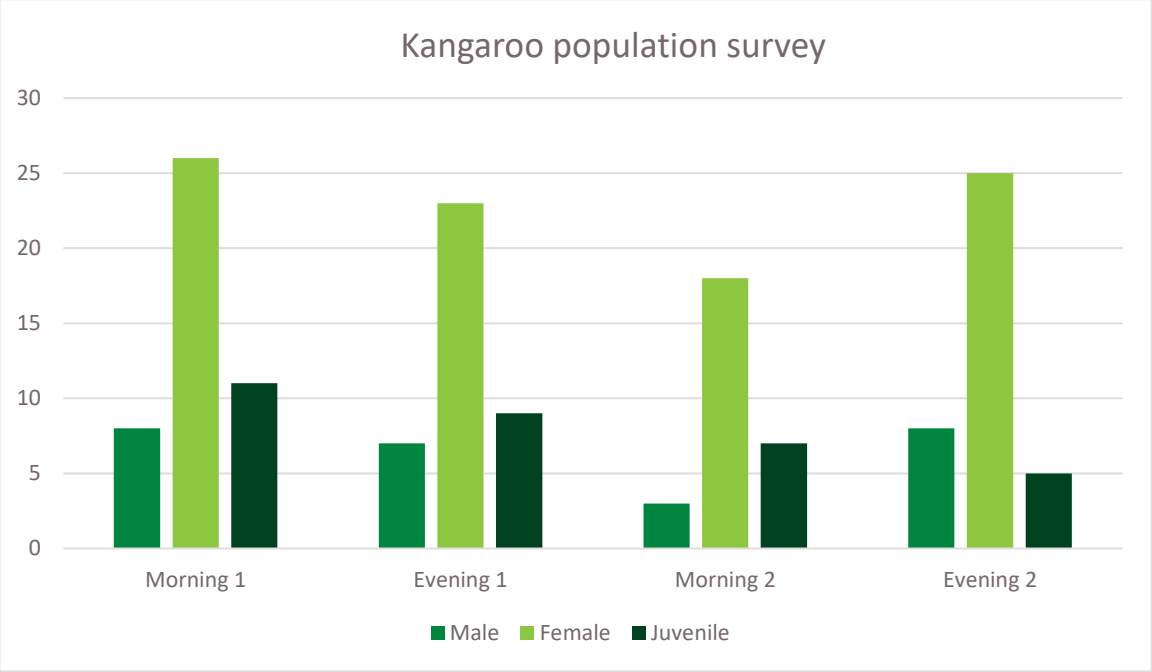

Table 1: Kangaroo population survey

Figure 2: Kangaroo recorded locations at time of survey

2.3. Potential Kangaroo management strategies

Across Australia, changes in land-use with European settlement have likely increased the area of suitable habitat for EGK by increasing stability of water sources, increased forest edge habitat (preferred by EGK) and increase irrigated lands providing increases in grass biomass. The increased availability of resources allowed for increased reproduction over longer periods. Historically, kangaroos were considered vermin, with large numbers culled at the encouragement of the Australian government. Between 1877 – 1907, approximately 8 million macropods were killed and presented to the QLD government as a part of a bounty system (Hrdina 1977). This led to the severe decline of the species, which resulted in harvesting eventually being regulated by 1970.

Today, several key strategies are used for the management of EGK across Australia (reviewed by Descovich et al. 2016). This includes:

- Culling via shooting
- Reproductive control
- Translocation
- Deterrents
- Resource control

2.3.1. Culling

Historically, shooting has been the most widely used method for controlling kangaroo populations, with ~3 million macropods killed annually for commercial and non-commercial purposes (Descovich et al. 2016). EGK culls are managed across multiple states, with quotas set based on annual estimates of population sizes. These quotas aim to set a proportion of the population that can be culled each year to reduce grazing pressure and crop damage, whiles maintaining viable population numbers (i.e., retaining enough reproductive adults to allow for the rate of mortality to be matched by the birth rate) (Pople 2008, Descovich et al. 2015). However, accurate population estimates to set quotas are difficult to obtain, with the species occurring across vast areas and often rapidly fluctuating in numbers (even within a single year). This can lead to over-harvesting during poor conditions such as drought, or under harvesting in optimal conditions where reproduction is likely to be high. Additionally, EGK may be seen at a higher risk to farming during times of drought, with individuals more visible because of a lack of foliage and clumped resources (e.g., human-made water sources) and presenting competition to stock for the limited remaining forage (Pople 2008). In NSW, the commercial take quota has varied between 15.5 – 22.8 % of the population, which has equated to a take of 170,800 – 704,010 EGK per year (based on 1989 – 2021 estimates) (NSW KMP Quota Report, 2021). Currently (based on 2020 surveys), the population estimates of EGK is 4.1 million individuals, with a 15.0% quota take (equating to 618,092 individuals able to be harvested in 2021). Currently density estimates for NSW range from 0.12 (Tidbooburra, Western Plains) to 41.8 (South-Eastern, NSW) km ^{2}.

Shooting is the most common lethal means of controlling kangaroos, both for commercial and non-commercial harvest (including to control by agricultural industries, to avoid human-animal conflict, isolation of unsustainable populations, and ecological sustainability). All lethal control must be carried out under the National Code of Practice for the Humane Shooting of Kangaroos and Wallabies for Non-Commercial Purposes or the Code of Practice for Commercial Harvesting (Descovich et al. 2015).

Although culling is sometimes necessary with overabundant populations that can become malnourished and emaciated, it is not preferable in most situations for ecological and ethical reasons. The current state guidelines suggest that culling may be necessary in the following situations:

- The kangaroos are landlocked by development and the land is not suitable for an in-situ population.
- The kangaroos were living in situ in manageable numbers, but the population now exceeds the sustainable limit. Culling a small number of kangaroos on an as-needed basis will likely be part of an in-situ management strategy.
- In situ management is neither feasible nor humane, and there are animal welfare and human safety risks.
- Sick, diseased or injured kangaroos in an otherwise healthy population must be euthanised.
- Individual kangaroos have become accustomed to human communities and are becoming bold or aggressive.

2.3.2. Reproductive control

Several non-lethal control options exist and have been used across Australia. Of the more recent options, reproductive control (or 'fertility control'), has been used across several populations with varying success. EGK reproductive control of both males and females has been used to reduce the population reproductive rate, including through surgical sterilisation, hormonal manipulation and immune-contraception (Hinds and Tyndale-Biscoe 1994, Nave et al. 2002, Herbet et al. 2006, Asquith et al. 2006, Kitchener et al. 2009, Tribe et al. 2014). Fertility control has been successfully used for several populations (Nave et al. 2002; Coulson et al. 2008; Herbert et al. 2010; Wilson et al. 2013; Wilson and Coulson 2016), with minimal effects on normal behaviour (e.g., feeding, vigilant behaviours, movement); though social hierarchies are known to change with fertility control (Poiani et al. 2002). As such, fertility control is often seen as a humane alternative to lethal control. However, it is not without risks, which are particularly associated with the capture and restraint (usually via chemical immobilisation) (Tribe et al. 2014; Descovich et al. 2015).

Hormonal manipulation and immune-contraception work by differing chemical pathways. Fertility control through hormonal manipulation involves using long-acting contraceptives containing either synthetic progestin (i.e., levonorgestrel which inhibits ovulation) or the gonadotrophin-releasing hormone agonist (i.e., deslorelin which inhibits ovulation and follicular development) (Herbert et al. 2010). These contraceptives are 87% and 96% effective, for > 5 years and 17 months, levonorgestrel and deslorelin respectively (Herbert et al. 2006, Herbert et al. 2010, Woodward et al. 2006). A permanent solution for reproductive control is surgical sterilisation, which has been caried out on both female and male EGK to prevent any reproduction by that individual. However, this is often not seen as a viable option for large, overabundant populations, given the high costs and potential for peri- and post-operative complications (Mosley and Gunkel 2007; Bauquier and Golder 2010; Tribe et al. 2014)

2.3.3. Translocation

The intentional movement of kangaroos from one location to an alternate, more suitable location, has been used widely for vulnerable species (Fischer and Lindenmayer 2000), though has been less widely used for common species. Translocation of common macropods has been used for urban populations who have or will become isolated with development, and that may begin to reduce the quality of their habitat by over-browsing. Due to their fission-fusion social structure, if translocated nearby, EGK are likely to be interacting with individuals they have previously interacted with, and aggressive exclusion

of new areas is less likely to occur in EGK than for many other species. Translocated EGK from development sites in Queensland were radio-tracked for up to one year post-release, were found to move into suitable habitat and establish a stable home range within one year after translocation (Higginbottom and Page 2010). However, translocation can be costly, particularly for large populations, and the chemical capture and transport can lead to potential injury or death of individuals in some circumstances (Higginbottom and Page 2010; Tribe et al. 2014, Descovich et al. 2015). Additionally, suitable translocation sites can be difficult to obtain in rapidly urbanising areas, where few interconnected green spaces large enough to support mobs are maintained.

2.3.4. Reduction of habitat suitability

Local over-abundance of EGK can be reduced by decreasing the suitability of habitat to the species. This can be done by either reducing the access to key resources, or by using auditory or olfactory deterrents in areas to discourage EGK from entering or staying in an area. EGK naturally fluctuate substantially with changes to food and water availability. However, in agricultural and urban settings, artificial water sources are often available, regardless of climatic conditions, and food supply increased by irrigating of land or via supplementary feeding of livestock, particularly during drought. The modification of the environment can potentially lead to prolonged periods suitable for EGK reproduction, resulting in population increases. By removing access to resources, EGK reproduction may stabilise or decrease, or they may move into more suitable area; though these strategies are rarely tested, and some evidence suggest that kangaroo abundance is not correlated with the presence of artificial water sources (Letnic and Crowther 2013). Removing water points and access to edible grasses and herbs can encourage dispersal of EGK and discourage EGK from moving into an area in a cost effective and non-invasive way. This can be done through exclusion fencing, which should meet the following specifications:

- Be chain-link (cyclone) fencing or deer mesh (also known as K wire)
- Not be ring-lock-style fencing (which is an entanglement hazard)
- Be high-tensile, heavy galvanised wire.
- Be at least 2.0 m high (deer mesh is produced in this size)
- Have no barbs.
- Have no loose or open wires.
- Be completely free of holes and gaps in, and under, the fence to stop the kangaroos trying to escape, and to stop them being injured.
- Prevent gaps at the base of the fencing by:
    - Having a secured mesh apron
    - Embedding the fence
    - Grading the fence line to eliminate dips.
    - Using crushed rock or concrete footing underneath

Deterrents can also be used in areas where EGK are unwanted. Ultra-sonic frequency or novel auditory devices have been used to frighten or discourage fauna from areas where they may cause property damage (such as in agricultural areas) or may cause traffic accidents (main roads). Ultra-sonic frequency auditory devices have been shown to have limited effectiveness on kangaroos (Bender 2003) however, with either no response, or rapid habituation to these noises, until no changes in behaviour are observed (Ramp et al. 2011). Alternative novel sounds, such a conspecific foot thumps, have shown to be more effective in deterring EGK from area (Bender 2004), though their long-term effectiveness is unknown.

Odour deterrents may also be used to discourage kangaroos from entering areas. Of the limited studies available, Parsons and Blumstein (2010) found that after 10 days of dingo odor treatment (using both urine and faeces), many macropods avoided the area entirely. This is most likely to be effective when deterrents are placed at entry / exit locations and would require ongoing management to replenish deterrents.

2.4. Other fauna species

Fauna habitat within the subject land (containing the VMP Area) including hollow-bearing trees, rocky outcrops (if present) and deep leaf litter was surveyed as part of the Biodiversity Development Assessment Report, please refer to this report for details (ELA, 2023). Three hollow bearing trees (HBT) and one hollow-bearing tree with a stick nest were located inside of the VMP area, these HBT's inside the VMP area should be retained.

Three hollow bearing trees (HBT's) within exotic vegetation *(Populus nigra)* inside the development footprint are scheduled to be removed. Prior to the removal of these (HBT's) a pre-clearance survey is required to determine any presence of fauna within the HBT's. The pre-clearance survey should also assess for any other habitat features or fauna present on the subject site. This survey should be conducted by the project ecologist. The project ecologist will also be required to supervise the removal of any habitat features identified in the pre-clearance survey.

The replacement of HBT's with artificial hollows or nest boxes require a minimum of one nest box for each hollow removed and should be installed within the VMP area under the supervision of an ecologist or bush regenerator. Nest boxes should be chosen to match the likely target species of each hollow. The placement of all nest boxes is to be carried out under the supervision and signoff of the project ecologist.

3. Management recommendations

3.1. Tree clearance surveys and nest box installation

A pre-clearance survey will be required prior to the removal of all trees approved for removal within the subject site. A previous assessment of the trees has been completed (BDAR ELA 2024) with habitat trees containing hollows and stick nests identified. The additional pre-clearance survey is to be conducted within two weeks of clearance commencing, and any existing and additional habitat features to be recorded with location, size and activity from native fauna. Clearance of all trees approved for removal is to be completed under the supervision of a suitably qualified ecologist.

Nest boxes should be placed in trees within the retained VMP Area and should be replaced at a ratio of 1:1 minimum for all hollows removed. The nest box installation should be completed prior to the removal of the identified trees containing hollow bearing limbs.

3.2. Kangaroo management strategies

The most appropriate management strategy is 'reduction of habitat suitability'. As such, this management plan looks to put in place measures to exclude the Kangaroos from the proposed development site by the staged implementation of a fauna fence or Kangaroo fence, that meets the requirements as stated in Section 2.3.4 of this report, to ensure that no Kangaroo can access the site during the construction stages. Observations of EGK within the development site to the north show that temporary fencing or construction fencing is not suitable to appropriately exclude Kangaroos from the development site.

The kangaroos that currently have access to the site will be carefully herded from the subject site onto the existing adjacent land they currently have access to within the WSU grounds or into the VMP area prior to the construction phase commencing.

The task of herding the Kangaroos and implementing fencing should be completed in a staged approach and completed under the strict supervision and guidance of an experienced ecologist and team. A representative from WIRES or other fauna rehabilitation groups may also form part of the team to assist in the unlikely event of injury or pouch young becoming separated from their mother. If any injured sick or orphaned Kangaroos are observed, the OEH Code of practice for sick injured or orphaned macropods is to be adhered to.

This management strategy should be implemented with consent from WSU and further arrangements for the management of the kangaroo population be discussed. For the purposes of this management plan the other management options listed under Section 2.3 are not recommended for the following reasons:

Culling: The current kangaroo population located within the subject site and surrounding lands have the capacity to move between the subject site, WSU land and potentially through other pathways to other portions of land. Due to the large number of Kangaroos that can potentially gain continued access to the site, culling would not successfully reduce or minimise the Kangaroo usage of the land. The location of the subject site is also within close proximity to housing, roads and shopping centre.

Reproductive Control: Similar to the reasons stated above reproductive control would not minimise or reduce the usage of the subject land by kangaroos. Reproductive control should be considered as an option for long term management of the population in conjunction with WSU.

Translocation: Translocation would require appropriate land to be identified, surveyed, and deemed to be suitable for EGK. Translocation should be considered as an option for the long-term management of the population, however due to the EGK population currently having unrestricted access between the subject site and WSU land, it cannot guarantee that Kangaroos will not access the site during the construction period. Currently, there are no potential travel paths for Kangaroos from the subject site to any suitable land other than the WSU site.

The translocation of Kangaroo species is often extremely difficult on a large scale and requires on-going management and long-term planning. Successful relocation of EGK relies on the identification of suitable sites with the following characteristics:

- Suitable resources available (most easily indicated by current EGK usage)
- Suitable resources are unlikely to be removed in the future (e.g., by future development plans)
- Moderate to high landscape connectivity to allow for future dispersal.
- Low to moderate current EGK density (i.e., no overabundant populations present)
- Low probability of injury or death during relocation (e.g., avoiding crossing of major roads and fence lines)
- Where funnelled or managed self-relocation by kangaroos is impossible due to suitable release locations not being connected other means are required.

The applicant is recommended to liaise with University of Western Sydney as part of future management of Kangaroo populations as the proposed development looks to remove approximately 3.93ha of land currently utilised by Kangaroos. This FMP can be provided to assist in any future management plans for Eastern Grey Kangaroos on WSU land.

3.3. Monitoring

To ensure the EGK cannot re-enter the site, during the construction phase, ongoing monitoring should be undertaken. If EGK are prevented from entering the site by exclusion fencing, daily monitoring of the fencing installation should be in place to ensure the fencing is constructed appropriately to exclude the kangaroos and to monitor the welfare of the kangaroos on site. Following exclusion and installation of the fencing, regular surveys of the site should be conducted to monitor for any fence breaches or EGK traversing the development footprint throughout the construction phase. If EGK do re-enter the site, relocation of these animals should be undertaken. Post-exclusion surveys should be conducted each day during exclusion, and once per week for six (6) weeks following the exclusion. The contractor on site should be responsible for the daily inspection of fencing and for any damages or breaches during the length of the works being completed. All breaches to the fencing should be repaired immediately.

If any Kangaroos are identified within the development site after the exclusion fence has been installed, works are to cease and the project ecologist or suitably trained wildlife carer should be contacted immediately. The project ecologist and/or suitably qualified wildlife carer will inform the contractor on the next appropriate steps, however no works will commence until the kangaroo has successfully been removed from the subject site.

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