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# C2CD OFFSET PEST ANIMAL MONITORING PROGRAM

December 2021

DEPARTMENT OF TRANSPORT AND MAIN ROADS

# Acknowledgements

Ecosure gratefully acknowledges Dr. Andrew Bengsen, Research Scientist for the Department of Primary Industry Vertebrate Pest Research Unit, for his expertise and advice during the development of this monitoring program, and Gympie Regional Council for their input into program design and review of this document.

# Acronyms and abbreviations

| | |
|---|---|
| BBBQ | Black-breasted button-quail |
| DAWE | Department of Agriculture, Water, and the Environment |
| DES | Department of Environment and Science |
| DPI | Department of Primary Industries |
| GIS | Geographical Information Systems |
| GLMM | Generalised Linear Mixed Model |
| HSE | Health Safety and Environment Plan |
| NSW | New South Wales |
| OMP | Cooroy to Curra Section D – Detailed Design Offset Management Plan |
| the project | Cooroy to Curra Section D project |
| QPWS | Queensland Parks and Wildlife Service |
| TMR | Department of Transport and Main Roads |

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# 1 Introduction

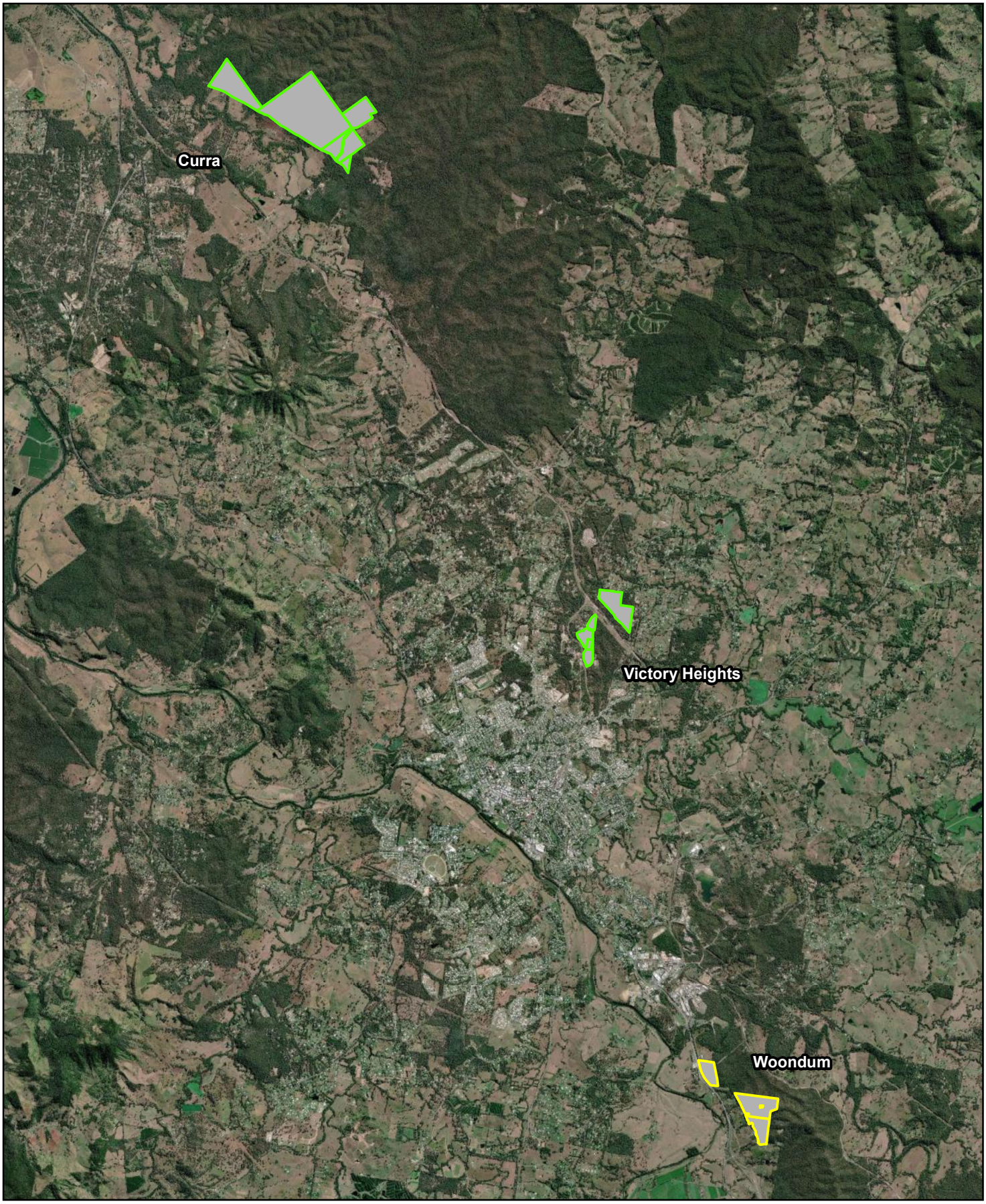
This program was designed for the Department of Transport and Main Roads (TMR) to guide pest animal monitoring across offset areas associated with the Cooroy to Curra Section D (C2CD) project (the project). TMR is responsible for managing pests in the 13 offset properties for up 10 years to support conservation of the koala (*Phascolarctos cinereus*) and black-breasted button-quail (*Turnix melanogaster*, BBBQ). Management in each offset property, and the surrounding landscape, will target pest species relevant to koala or BBBQ i.e. fox (*Vulpes vulpes*) and wild dog (*Canis lupus familiaris*) in koala offset properties and fox, wild dog, pig (*Sus scrofa*), and feral cat (*Felis catus*) in BBBQ offset properties. This program has been designed to monitor changes in abundance of these pest species in the relevant offset properties.

## 1.1 Site context

The offset properties are located in three main clusters across Gympie: Curra cluster, Victory Heights (Victory) cluster, and Woondum cluster (Figure 1). Curra represents the largest of the offset clusters, covering approximately 239 ha, while Victory and Woondum cover approximately 46 ha and 56 ha respectively (Table 1).

Table 1 Offset site details

| Cluster Location/name | Lot/Plan | Offset protection species | Area (ha) | Total area (ha) |
|---|---|---|---|---|
| Curra | 1MPH23906 | Koala | 27.68766846760 | 239.4400439 |
| | 3MPH23906 | Koala | 22.97086937060 | |
| | 4MPH23906 | Koala | 3.45748512669 | |
| | 878MCH1061 | Koala | 144.55792654000 | |
| | 889CP864404 | Koala | 40.76609436390 | |
| Victory | 19SP299683 | Koala | 26.85805422630 | 45.58392789 |
| | 1MPH23904 | Koala | 5.85234151421 | |
| | 1MPH5670 | Koala | 2.02291908153 | |
| | 2MPH14193 | Koala | 7.26701692069 | |
| | 763MCH5342 | Koala | 3.58359614971 | |
| Woondum | 102SP297908 | Koala + BBBQ | 12.65606044640 | 56.08536792 |
| | 2SP302526 | Koala + BBBQ | 15.17692846710 | |
| | 3SP302524 | Koala + BBBQ | 28.25237900770 | |




## Figure 1: Offset sites

Pest Animal Monitoring Program

**Offset protection species**

- Koala
- Koala + black-breasted button-quail

ecosure

Job number: PR5620
Revision: 0
Author: EK
Date: 19/08/2020

0 0.5 1 2
Kilometers

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

# 2 Methods

## 2.1 Desktop assessment

Relevant literature and aerial imagery were reviewed before designing the monitoring program.

### 2.1.1 Literature review

Relevant literature regarding the project site, pest monitoring techniques, statistical analyses, and similar survey designs were reviewed including:

- Cooroy to Curra Section D – Detailed Design Offset Management Plan Draft (Draft OMP; GHD 2020)
- peer-reviewed scientific literature regarding pest monitoring, statistical analyses, and species-specific information (e.g. Bengsen et al. 2011a, Bengsen et al. 2011b, Bengsen et al. 2014, Read et al. 2015, Hepsen et al. 2019, Thompson et al. 2019)
- terrestrial monitoring guidelines (e.g. Mitchell & Balough 2007, Meek et al. 2012).

Currently, there are no Department of Agriculture, Water and the Environment (DAWE) guidelines specifically relating to the monitoring of vertebrate pest species. The Draft OMP refers to the use of The Queensland Herbarium's (Department of Environment and Science; DES) Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (version 3.0, June 2018) to guide the monitoring design. However, these guidelines do not provide specific information for monitoring pest species and are instead a general guideline for all fauna surveys. Where relevant, Ecosure has designed the monitoring program to align with these survey guidelines, though other methods and techniques have also been adopted from other vertebrate pest-specific manuals (e.g. Mitchell & Balogh 2007, Meek et al 2012, Verbeek & McLeod 2018).

The literature review established the most suitable monitoring techniques for relevant pest species (i.e. wild dogs, foxes, feral cats, feral pigs) and project site, and ensured the survey design and statistical analyses would meet the objectives of the scope of works described in Schedule 5 – Service Specification Attachment 1 – Project Brief (2018-2019-T138-L001).

### 2.1.2 Aerial imagery assessment

Preliminary GIS mapping of the broader project site (including the planned 5 km pest animal management buffer area) was undertaken to understand the spatial layout of the offset areas within the landscape. Movement corridors such as roads, tracks, fire breaks, creek lines, cleared easements and fence lines provide movement pathways for some pest species. It is important to identify corridors surrounding the offset sites to understand the likely movement paths for wild dogs and foxes. Accordingly, movement corridors were identified within a 5 km radius of the offset sites (Figure 2 - Figure 4). This analysis included roads, Queensland Parks and Wildlife Service (QPWS) access tracks, and creek lines; unfortunately, other spatial layers

including fire breaks, recreational tracks, and cleared easements are not publicly available. Aerial images for each offset site were analysed closely and possible tracks (i.e. cleared areas that resemble tracks) were identified and included in Figure 2 - Figure 4.

## 2.2 Consultation

The monitoring program was designed through inhouse consultation between suitably qualified persons with expertise and experience specific to koala, BBBQ and relevant pest species (i.e. wild dog, fox, feral cat, pig). A summary of personnel experience is outlined in Appendix 1. Dr. Andrew Bengsen (Vertebrate Pest Research Scientist, Department of Primary Industries) also provided his expert knowledge through the development of this program.

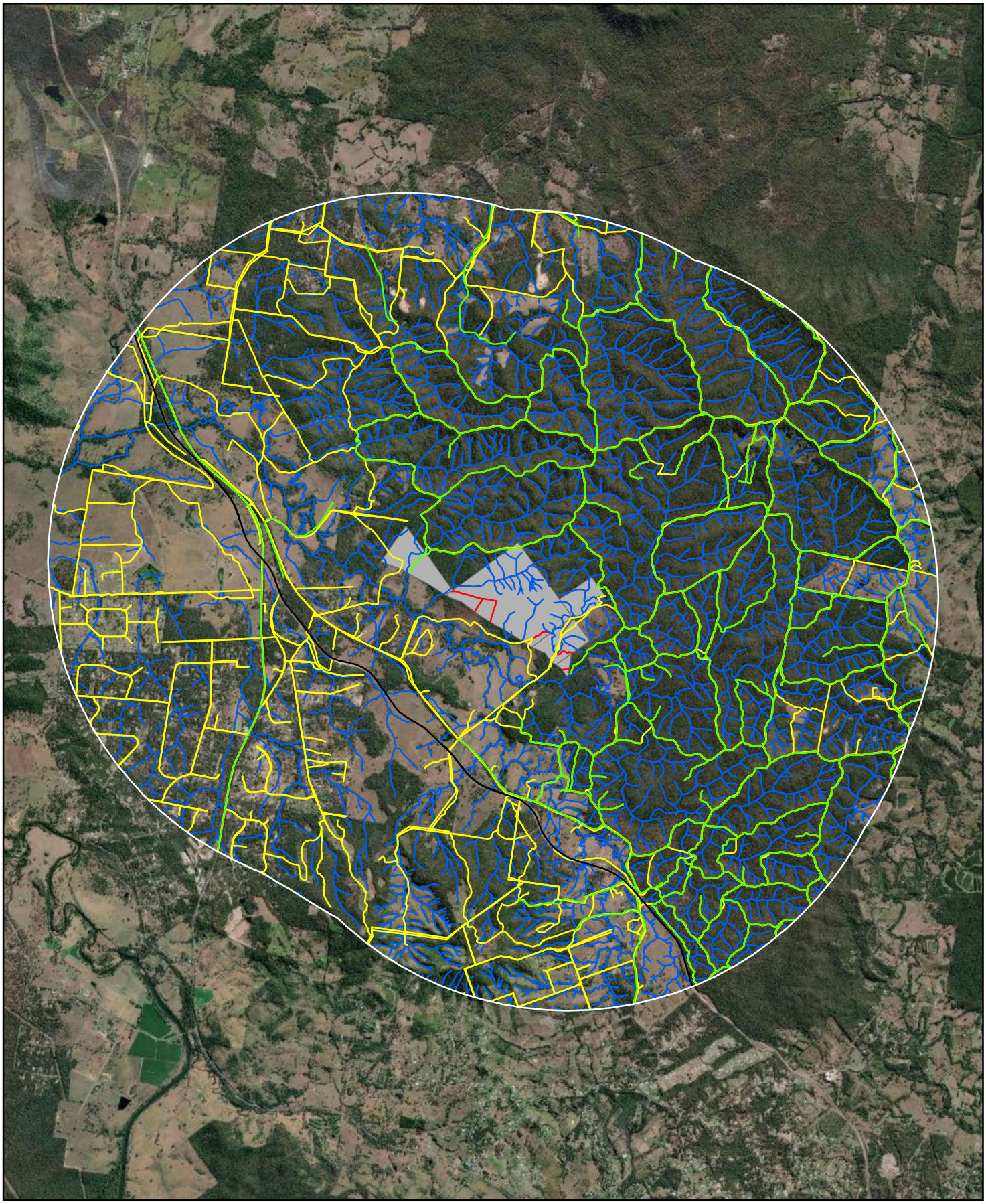



**Figure 2: Curra movement corridors**

Pest Animal Monitoring Program

ecosure

Job number: PR5620
Revision: 0
Author: EK
Date: 20/08/2020

0 350 700 1,400
Meters

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



PR5620_MP2_CurraMovementCorridors
A4

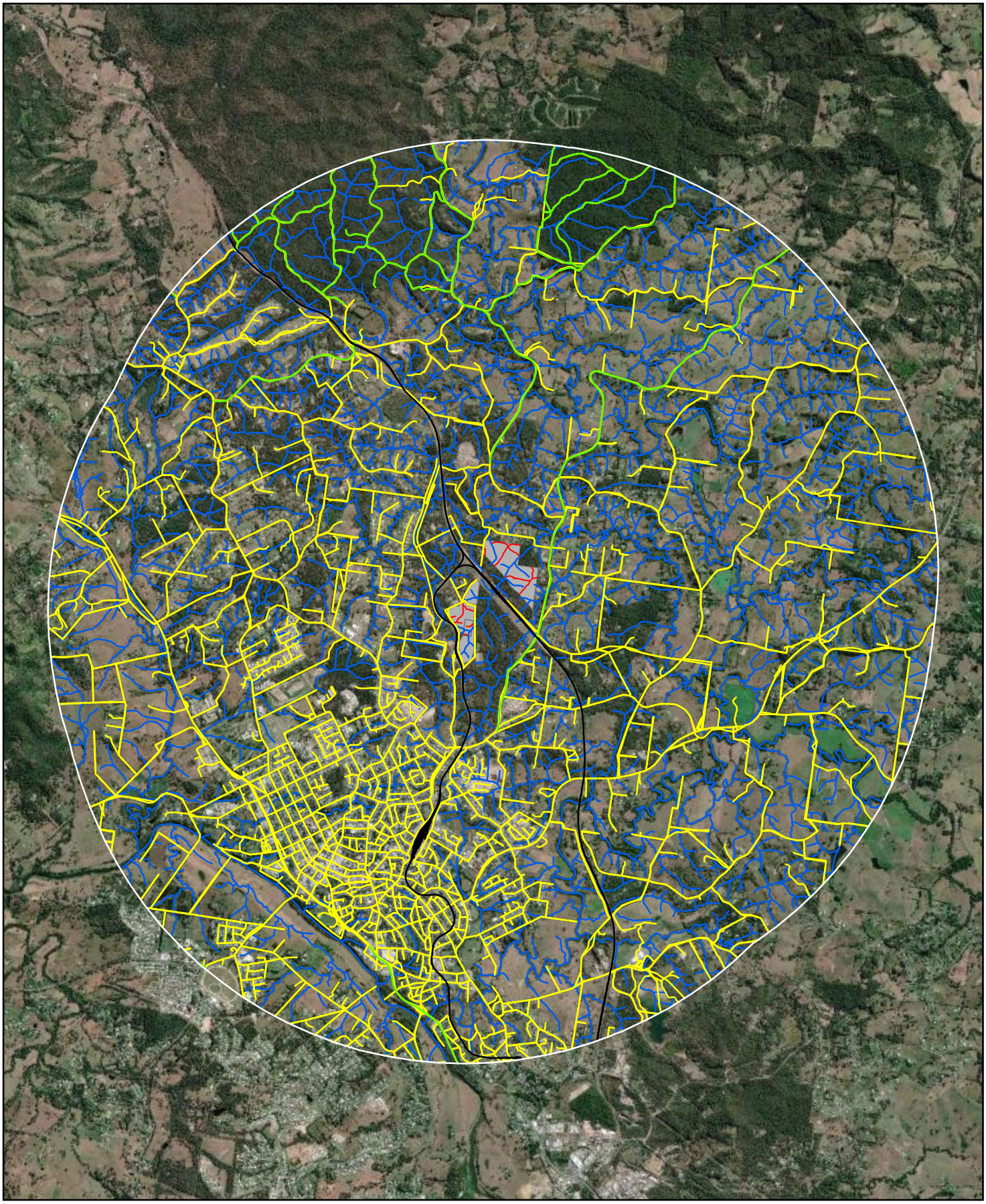


**Figure 3: Victory movement corridors**

Pest Animal Monitoring Program

Road
QPWS access road
Watercourse
Potential tracks
5 km buffer
Offset cluster

ecosure

Job number: PR5620
Revision: 0
Author: EK
Date: 19/08/2020

0 250 500 1,000
Meters

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

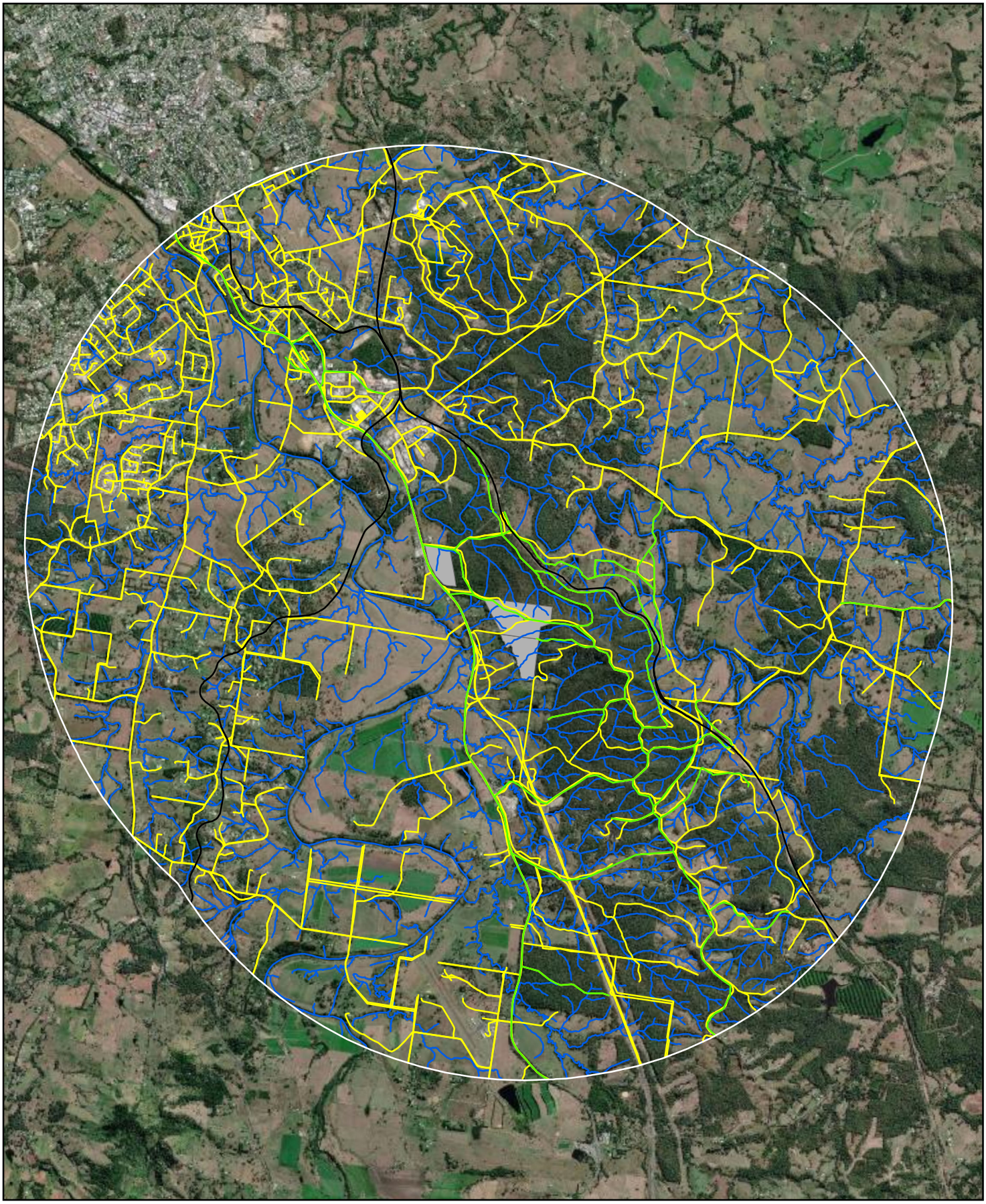


**Figure 4: Woondum movement corridors**

Pest Animal Monitoring Program

Road
QPWS access road
Watercourse
Rail network
5 km buffer
Offset cluster

ecosure

Job number: PR5620
Revision: 0
Author: EK
Date: 19/08/2020

0 250 500 1,000
Meters

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



PR5620_MP4_WoondumMovementCorridors
A4

# 3 Monitoring Program

In the absence of state or federal guidelines relating specifically to the monitoring of vertebrate pest species, the following monitoring program has adopted methods and techniques supported through contemporary, peer-reviewed scientific publications, and pest-specific manuals (e.g. Mitchell & Balogh 2007, Meek at al 2012, Verbeek & McLeod 2018). While a number of limitations exist (Section 3.7) that inhibit the ability to conduct a survey that would be of a scientific standard suitable for a peer-reviewed academic publication, the monitoring program provides a scientifically robust and repeatable methodology that can be used to illustrate changes in pest abundance over time.

## 3.1 Target pest species

### 3.1.1 Koala offsets (wild dogs and foxes)

The target species for koala offset areas (all 3 cluster groups) are wild dogs and foxes. Wild and domestic dogs pose a key threat to koala populations, particularly in peri-urban areas (Gentle et al. 2019). Foxes are also known to predate on smaller koalas (i.e. juveniles, sub-adults; Ramsay 1999), though to a lesser extent than wild dogs.

Wild dogs and foxes preferentially travel along roads and tracks and use these passages for territorial marking (Triggs 1996, Mitchell & Balogh 2007, Raiter et al. 2018). As such, monitoring will target roads, tracks, and any other movement corridors (e.g. dry creek beds, tree lines, stock routes, 4WD tracks, fire breaks, bushwalking trails, railway lines, powerline easements) to maximise data capture on these species.

Fox home ranges can vary depending on sex (i.e. males have a larger home range than females) habitat type/landscape (e.g. temperate agricultural, coastal, arid/semi-arid, urban, semi-urban) (Cater et al. 2011), food availability, and fox density (Verbeek & McLeod 2018). In general, home ranges vary between 2 and 5 $km^2$ (Verbeek & McLeod 2018).

Wild dog home ranges are larger than those of foxes and can vary greatly depending on food availability (DAF 2016a). Individuals in eastern NSW have been recorded with an average home range of 40 $km^2$, though home ranges can vary between 4 $km^2$ and 1000 $km^2$ (DPI n.d.). As a result, planned methodology for pest control covers a zone that extends 5 km from the offset clusters to enable the best chance of managing pests that may impact the offset protection species.

Foxes and wild dogs are nocturnally and diurnally active but are most active during the night and at dawn and dusk (McNeill et al. 2016, Verbeek & McLeod 2018). Wild dog activity generally peaks in spring and early summer when wild dogs are dispersing after the breeding season (McNeill et al. 2016, DAF 2016b, North Coast Local Land Services 2019). Fox densities have been shown to peak in summer (Coman et al. 1991), with cubs emerging from dens in late spring and dispersing from family territory in late summer to early winter (Gentle 2006, DSEWPC 2010). Dens are generally used during early spring to summer and are otherwise vacant (Gentle 2006).

Table 2 Reproductive calendar for red fox (*Vulpes vulpes)* and wild dog (*Canis lupus familiaris)* (Gentle 2006, DSEWPC 2010, DAF 2016b).

| | Summer | | | Autumn | | | Winter | | | Spring | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Dec *** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov *** |
| **Fox** | | | | | | | | Breeding | | | | |
| | | | | | | | | | Whelping | | | |
| | | | Dispersal | | | | | | | | | |
| | | | | | | | | | | | | Cubs emerge from dens |
| **Wild dog** | | | | | | Mating | | | | | | |
| | | | | | | Breeding | | | | | | |
| | | | | | | | Whelping | | | | | |
| | Dispersal | | | | | | | | | | | |

* Optimal period for monitoring

### 3.1.2 Black-breasted button-quail offsets (wild dogs, foxes, feral cats, and feral pigs)

The target species for BBBQ offset areas (Woondum Cluster only) are wild dogs and foxes (as discussed in Section 3.1.1), feral cats and feral pigs. Wild dogs, foxes, and feral cats are recognised as key predators of BBBQ, while feral pigs pose a threat to populations primarily through habitat degradation (e.g. destruction of sheltering sites and introduction of exotic weeds) (Mathieson & Smith 2009, OEH 2019).

Pig home ranges can vary between 10 and 50 $km^2$ for males and 5 and 20 $km^2$ for females, though if food availability is high this home range can be restricted to within 5 km of an adequate food source (Agriculture Victoria 2020). Home ranges of sows and piglets can be even more restricted to around 0.16 $km^2$ (Agriculture Victoria 2020). Feral pigs regularly visit wallowing sites and water sources and are known to travel in groups (Agriculture Victoria 2020). Feral pigs are known to travel along roads and tracks and utilise trails to travel between food/water sources (similar to wild dogs and foxes); however, this is not always the case (Engeman et al. 2013).

Feral cat home ranges can vary depending on resource availability (including food and den sites) and sex, with males having a larger home range of up to 10 $km^2$ (Mitchell & Balough 2007). A study conducted in central-western New South Wales showed that feral cats had an average home range of approximately 2.5 $km^2$ (Molsher et al. 2005). Feral cats show a lesser preference for travelling along roads in comparison to foxes and wild dogs, with a recent camera-trapping study revealing that feral cats were observed travelling along roads in only 21% of images (Raiter et al. 2018).

Feral cats and feral pigs are predominantly nocturnal but are also active at dawn/dusk (Mitchell & Balough 2007). Unlike wild dogs and foxes, feral cats and feral pigs do not appear to have a peak activity season/month as breeding is generally dictated by environmental conditions and resource availability (Mitchell & Balough 2007).

## 3.2 Monitoring techniques

### 3.2.1 Assessment of monitoring techniques

Appropriate monitoring techniques were determined through analyses of scientific literature and aerial assessments of the site. Techniques considered in this process included camera trapping, spotlighting, track and scat searches, sand plot surveys, and detection dog surveys.

Camera trapping is widely used as a method of monitoring pest abundance before and after management actions (Bengsen et al. 2014, Bengsen 2014, Comer et al. 2018, Hepsen et al. 2019, Thompson et al. 2019) and is a key tool for pest management in Australia. Camera trapping is considered to have the highest applicability to fox, wild dog, and pig monitoring in comparison to other techniques (Verbeek & McLeod 2018). In addition, it has been shown to provide data that is more sensitive to population changes over time in comparison to track/scat searches in pig populations (Massei et al. 2017). Camera trapping is also suited to capturing

the presence of elusive animals such as feral cats (Fisher et al. 2015). Other techniques such as sand plot and spotlight surveys are often used to monitor pest populations, however camera trapping collects the same quantitative information as these techniques and is more applicable to the physical and logistical parameters of this project.

The use of detection dogs was considered as a tool to identify dens for pest management (i.e. fumigation), though this was deemed out of scope for the monitoring plan and more appropriate for inclusion into the pest management plan. Detection dog surveys could also be used to visually represent distribution of animal signs (e.g. scats, scent trails, dens), though pest distribution can be visually represented using camera trap data. In order to avoid redundancy in data collection and ensure a robust and comparable data set over time, camera trapping will be used as the main survey technique to monitor changes in abundance over time. Detection dogs *may* be used to assist in locating suitable locations for cameras in the first year of monitoring, or to determine presence/absence of pest species, as discussed in Sections 3.3.1 and 3.8.3.

### 3.2.2 Selected monitoring technique – camera trapping

There are a range of camera brands and types that can be used to monitor pest populations (Meek et al. 2012, Verbeek & McLeod 2018). Reconyx Hyperfire 2 is the preferred camera for this monitoring program. If other camera models are used, operators should be aware of the technical and operational differences between models to ensure settings are adjusted accordingly. As per recommendations provided by Verbeek & McLeod (2018), cameras will be set to capture images with the following settings: rapidfire, no delay, 10 images per trigger, 3.1-megapixel resolution, high-medium sensitivity, night mode: fast shutter or high quality. There is some evidence to suggest that wild dogs, foxes, and feral cats can react adversely to white-flash and infrared camera traps (Meek et al. 2012). Between the two, infrared camera traps are considered to have less of an effect on animal behaviour (Meek et al. 2012) and will therefore be used for camera monitoring in this program. In order to standardise detection probability, camera instalment protocol, camera sensitivity and trigger settings will be held constant across all monitoring sites (Meek et al. 2012). For further information regarding spatial distribution of cameras, timing of surveys and data analysis, see Sections 3.3 - 3.5.

## 3.3 Spatial design

Due to the close proximity of offset sites/lots, movement between sites within each cluster (i.e. Woondum, Curra, Victory) is highly likely given the movement patterns and home ranges of target species. Given this, it would be difficult to accurately discern differences in species abundances between offset sites/lots within the same cluster over time. As such, the sites will be monitored in cluster groups; Woondum cluster, Curra cluster, Victory cluster (see Table 1).

The following spatial layouts have been designed through analysis of aerial imagery and desktop mapping of movement corridors (see Section 2.1.2). A site assessment has not been conducted to verify the suitability of camera configurations in each offset cluster. The number of cameras and their locations proposed below are therefore indicative only and may be adjusted during deployment if necessary. For example, a camera location may be chosen via

desktop mapping based on its position along an existing track; however, this location may be deemed unsuitable in the field if the track no longer exists or is not likely to be utilised as a pest animal movement corridor. Exact placement of cameras, including direction, height, and coordinates, will be recorded to ensure consistent setup in following years.

### 3.3.1 Curra & Victory Offsets

Cameras will be passively placed (i.e. non-baited) along roads, tracks, and other pathways to maximise the chance of encountering dogs and foxes that use these paths as movement corridors (Verbeek & McLeod 2018). Cameras will be placed approximately 30 cm from the road/track edge, 50 cm above the ground, and at an angle and direction suitable for capturing quality images of dogs and foxes (e.g. facing away from the sun's path) (DPI 2018). Cameras will be attached to stable, permanent structures such as tree trunks and fence posts. Vegetation in front of the cameras will be cleared to reduce the number of false triggers and maximise pest animal detectability.

DPI guidelines suggest that a robust predator monitoring program should utilise at least 20 – 30 cameras, spaced approximately 1 km apart (DPI 2018). Given the offset clusters are relatively small, placing cameras 1 km apart would result in a very low sample size which is unlikely to detect changes in pest activity through time. In order to ensure the appropriate number of cameras and spatial coverage for the study, cameras will be spaced approximately 250 m apart. This will increase the detection probability of pest animals within the offset clusters and increase the strength of statistical analyses.

A 250 x 250 m grid was overlaid onto the Curra and Victory offset clusters to determine indicative monitoring locations. The 250 x 250 m grids were rotated to maximise the number of camera locations in each cluster, resulting in 43 cameras in Curra and 12 cameras in Victory. Cameras will be placed at the closest suitable site (i.e. movement corridor) to each grid point (as per Kammerle et al. 2018); preferably within 20 – 50 m of the central grid point (A Bengsen 2020, pers. comm., 18 August). Effort will be made to keep cameras 250 m apart to maintain adequate spatial coverage, though the statistical analysis does not rely on spatial independence between cameras. Figure 5 and Figure 6 show indicative camera locations relative to known and suspected (i.e. suspected from visual analysis of aerial imagery) movement corridors in each offset site. Exact camera placements will be established during field placement when suspected corridors can be ground-truthed and new corridors can be identified (e.g. game trails). In the event that a cleared track/road is not available within the grid cell, the camera will be placed at the next most suitable site available (e.g. game trail, habitat edge). Detection dogs may be used to identify suitable locations based on animal signs (e.g. scents, scats) if field crew are unable to.

### 3.3.2 Woondum Offset

Foxes, wild dogs, feral cats, and feral pigs all have different movement patterns and behaviours that can be targeted using an array of different spatial configurations for camera traps (e.g. Robley et al. 2010, Bengsen 2011a, Bengsen et al. 2011b, Bengsen et al. 2014, Stokeld et al. 2015, Massei et al. 2018, Nichols et al. 2019). In order to target all four species, 13 cameras will be distributed across a 250 x 250 m grid, ensuring adequate spatial coverage

across the offset cluster (Figure 7).

Multiple studies have used different camera trap placements to capture feral cats (e.g. Robley et al. 2010, Bengsen 2011a, Stokeld et al. 2015, Nichols et al. 2019), though their elusive nature provides challenges for camera detectability. In order to maximise the detection of feral cats, 50% of the camera traps (i.e. seven of the thirteen camera traps) will be baited with an audio and olfactory lure that will attract feral cats without providing a reward that can be taken. Audio and olfactory lures have proven successful in attracting feral cats, while visual lures have had varied success (Edwards et al. 1997, Moseby et al. 2004, Read et al. 2015). Audio lures are also advantageous as they offer consistent output and do not need regular replacement (Moseby et al. 2004). The lure status of each camera trap within the Woondum cluster will be factored into the data analysis. The remaining six cameras will be placed at the nearest suitable location to the central grid point (i.e. movement corridor), as per in the Curra and Victory offset clusters (Figure 7). This will maximise the chances of encountering foxes, wild dogs, and feral pigs.

As per the koala offset camera trapping, exact placement of cameras (e.g. direction, height, and coordinates) will be recorded to ensure consistent setup in following years. Species detectability at each camera station should remain constant throughout the monitoring project period. If this changes (e.g. due to vegetation clear, fire, wind), cameras may be moved to nearby suitable locations that are deemed to have the same level of detection probability.

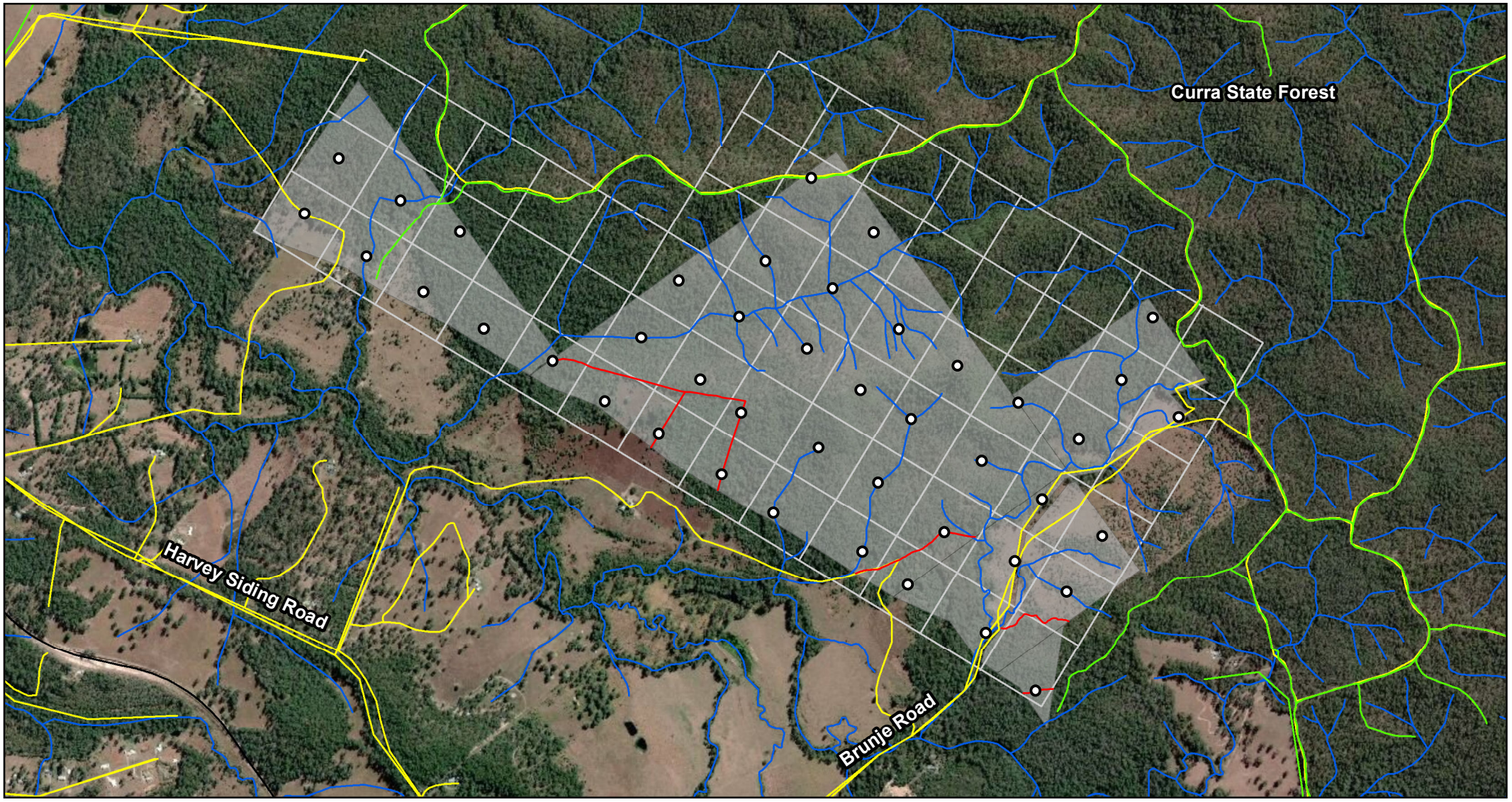



**Figure 5: Indicative camera locations in Curra**

Pest Animal Monitoring Program

Indicative camera locations
Potential tracks
Road
Rail network
QPWS access road
250 x 250 m grid
Watercourse
Offset cluster

ecosure

Job number: PR5620
Revision: 0
Author: EK
Date: 20/08/2020

0 175 350 700
Metres

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


**Figure 6: Indicative camera locations in Victory**

Pest Animal Monitoring Program

Road
QPWS access road
Watercourse
Potential tracks
Rail network
250 x 250 m grid
Offset cluster

ecosure

Job number: PR5620
Revision: 0
Author: EK
Date: 20/08/2020

0 40 80 160
Meters

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

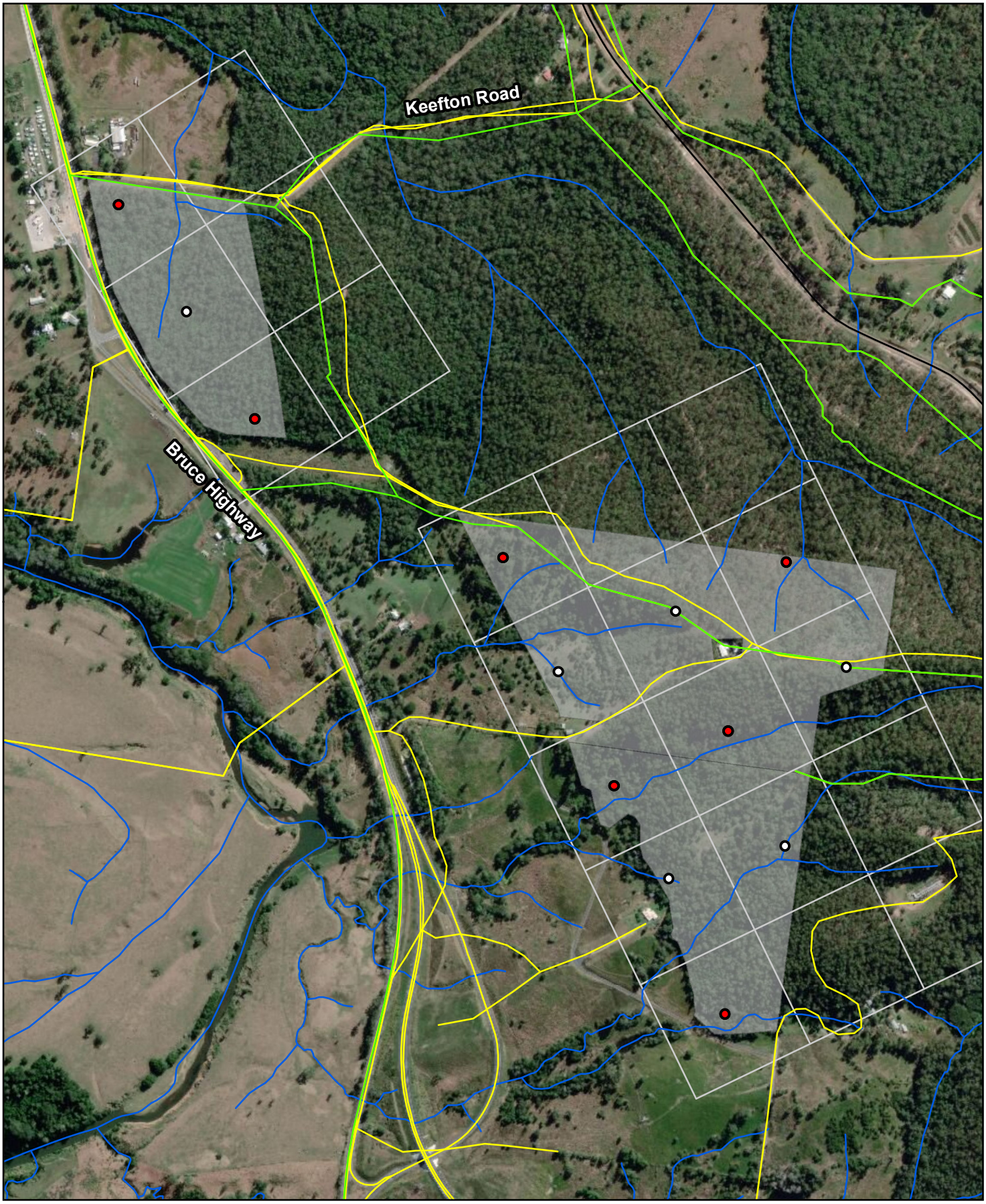



**Figure 7: Indicative camera locations in Woondum**

Pest Animal Monitoring Program

Indicative camera locations
Baited cameras
Road
QPWS access road
Watercourse
Rail network
250 x 250 m grid
Offset cluster

ecosure

Job number: PR5620
Revision: 0
Author: EK
Date: 20/08/2020

0 40 80 160
Meters

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



PR5620_MP7.1_SpecificWoondumCameraLocations
A4

## 3.4 Temporal Design

Camera traps will be deployed for a period of eight weeks each year to adequately sample each offset cluster for relevant pest species. An eight-week camera trap monitoring event was chosen as it is double the minimum survey effort outlined in monitoring guidelines (Meek et al. 2012, DPI 2018, Verbeek & McLeod 2018) and can be implemented for the provided target project budget. Cameras will be deployed throughout November and December to coincide with increased fox and dog activity (Table 2). Considering feral cats and feral pigs do not have defined periods of peak activity, this timing will also be suitable for these species. This timing also coincides with the BBBQ breeding season (September – May). It is vital that survey periods remain consistent over the full extent of the monitoring period to ensure data is comparable over time.

## 3.5 Data analysis

Offset clusters are spaced 10-11 km apart and are assumed to be independent of each other for the purpose of data analysis. Data collected in each cluster will therefore be analysed independently from other clusters. All images will be retrieved from cameras and the incidents of detection of each predator species will be recorded.

### 3.5.1 Image sorting

Camera trap data can often be analysed using a mark-resight approach, which relies on the individual identification of animals based on unique markings or morphological traits. While there is a possibility to individually identify some target pest animals, a mark-resight approach has been deemed unsuitable for this study as the survey sites are too small relative to pest animal home ranges. Generally, to use this approach, the survey sites must be large enough to encompass multiple full home ranges.

As an alternative approach, a five-minute window will be used to discriminate between independent events/observations, i.e. an event/observation will be considered independent if it is separated from the preceding image/s by over five minutes. This time window is based on the frequency of repeated detection of the same species on a single camera, which has been shown to decrease rapidly after five minutes for deer, feral pigs, and foxes (A Bengsen 2020, pers. comm., 18 August). The five-minute rule will be applied to all passive camera trap data. To test the suitability of this rule for baited camera trap data, histograms showing the time between consecutive records of the same species at single cameras will be visually analysed to estimate the window in which repeated detection of the same species drops off. The presence of a lure may encourage animals to linger for a longer period of time, meaning that a larger time window may be needed to accurately define independent events. The determined and utilised time rule for lured cameras will be detailed in the reported results.

### 3.5.2 Statistical analysis

Due to the challenges of deriving an absolute population abundance of each pest species within the offset clusters, an activity index will be used to describe the changes in relative pest

abundance over time (as per Bengsen 2014 and Thompson et al. 2019). The data from each camera will also be used to show the spatial distribution of pest animals throughout the offset clusters, which will be complemented by data from the control program.

An activity index will be calculated for each species in each offset cluster per year (as per Bengsen et al. 2014). Generalised linear mixed models (GLMM) will be used to calculate activity indices for relevant pest species in each offset cluster i.e. fox and wild dog activity indices for Curra and Victory; and fox, wild dog, feral cat, and pig activity indices in Woondum. The parameters of the model will be as follows:

| | |
|---|---|
| ***Response variable*** | *Number of fox/dog/cat/pig observations recorded at each station on each day* |
| ***Fixed effect*** | *Year* |
| ***Random effects*** | *Day, camera station* |
| ***Error distribution*** | *Poisson distribution with log link* |

Considering 50% of the cameras in Woondum will be lured, 'lure status' will be included as a covariate in the GLMMs for Woondum pest species. The type of trail/track (e.g. game trail, paved road, unpaved forest track etc.) may also be included as a covariate in the GLMMs to account for possible differences in probability of track use by pest animals across different track types (Kammerle et al. 2018).

The coefficients from each GLMM output will be back-transformed to create an activity index representing the expected number of pest animals per camera per day. This method of calculating activity index combines the raw observational data with the probability of detecting pest animals and is therefore a more accurate estimation of pest abundance than raw data. This method also does not require spatial independence between camera stations within offset clusters, which would be violated if using other statistical methods as cameras are not spatially independent from one another. One-tailed z-tests will be used to determine if pest abundance (i.e. pest activity index) decreases between years.

A key assumption for this analysis is that a decrease in activity index is representative of a decrease in absolute abundance. Given that the activity index is based on camera trapping rates, there is also an assumption that detection probability is stable over time i.e. there is the same probability of detecting a fox at a particular camera station in year one and year three. Detection probability can be influenced by a number of factors, such as vegetation type, camera placement, and time of year (particularly for species that have defined breeding seasons). In order to meet this assumption, it is vital that camera placement and survey timing remains consistent across the monitoring program period.

## 3.6 Reporting

A pest monitoring report will be prepared annually summarising the results from the camera monitoring period. The report will include the methods of field monitoring and statistical analysis, as well as a result (including graphs and maps to visually display data), discussion and conclusion section.

## 3.7 Limitations

### 3.7.1 Activity index

Activity indices are generally relied upon to detect signals from large changes in animal activity and may not be as effective in detecting signals from small changes. This is because there are multiple sources of variation that can affect the number of animals detected on cameras, meaning that activity indices are inherently noisy. The activity indices derived from this study are likely to be particularly noisy due to the small size of offset clusters relative to the size of individual home ranges; i.e. the offset clusters are likely to only encompass a subset of a single animal's or social group's home range. This is likely to cause high variability within and between surveys. Essentially, this limitation means that changes in pest abundance may not be detected by activity indices unless there is a significant change in pest abundance. While the study has been designed to reduce variability and increase signal strength where possible (e.g. good spatial coverage and standardisation), this limitation should be considered when interpreting results. Despite this limitation, deriving an activity index is still the most appropriate method for this study due to a number of factors; primarily the small size of offset clusters.

### 3.7.2 Control sites

Another key limitation in this study is the lack of control sites. Control sites have not been included in this study due to the large number of unknown and uncontrollable variables in the surrounding landscape (e.g. private property), making it difficult to assign appropriate control sites that are guaranteed to remain 'untreated' throughout the life of the program. Control sites are important in testing the effect of a particular treatment (in this case, pest management) as they provide baseline results for comparison with treatment sites. Essentially, they allow you to discern if the effects seen in treatment sites are a direct result of the treatment being applied, or if there are other factors that may be contributing to the observed effect. In the case of this program, the lack of control sites means that observed changes in pest abundance/activity over time may not necessarily be the direct result of pest management actions, and may instead reflect changes in behaviour to avoid certain areas, weather events, and/or environmental changes. This limitation should be considered when analysing and interpreting the results.

### 3.7.3 Offset cluster size

All three offset clusters encompass a relatively small area, particularly Victory and Woondum. As a result, any effects of pest control at this scale are likely to be overwhelmed by immigration from the surrounding landscape unless the control effort is so intense that it lowers population densities at a scale well beyond the offset clusters. While this is a limitation of pest monitoring, it is more so a limitation of the pest management itself if management were to only occur within offset clusters. To address this limitation, TMR will engage with Gympie Regional Council for a collaboratvie, cross-tenure approach.

### 3.7.4 Length and number of surveys

A further limitation is the length and number of surveys per year, a factor that is limited by budget. In an ideal monitoring program (particularly one with no control sites), multiple surveys should be conducted throughout the year to increase replication and thus increase the statistical power of the study. These could also be timed to occur pre- and post-management to evaluate the effectiveness of management efforts. This latter option is not appropriate for this study as control effort will likely be on-going throughout the year and responsive to actual on-ground pest animal activity. Conducting only one monitoring event each year will provide sufficient data to determine overall changes in pest abundance/activity over time, though this limitation should be considered when interpreting results. While an eight-week monitoring period is suitable for this program given the budgetary constraints, it should be noted that a three-month monitoring period would be optimal and is the standard survey length adopted by DPI for camera trapping surveys (A Bengsen 2020, pers. comm., 23 July).

### 3.7.5 Timing

A further possible limitation in this program is the timing of camera trap surveys. The late-spring/early-summer period was chosen based on the peak activity of foxes and wild dogs. However, peak activity times for foxes, wild dogs, feral cats, and feral pigs has not been exclusively studied in the Gympie region, so this monitoring period may not directly coincide with the peak activity of all target pest species. This has the potential to impact species detectability; however, if surveys are conducted at the same time each year, the overriding trend in species abundance/activity should remain the same.

C1 (south) works are scheduled to commence in October 2020 and C2 (north) works are scheduled to commence in February 2021. Ideally, baseline monitoring (first monitoring event) would be conducted prior to any construction works occurring in close proximity to the offset clusters, so as not to disturb pest species. Noise disturbances from construction works may lead to behavioural changes (e.g. more elusive behaviour) which could impact the detectability of animals on camera traps, resulting in an activity index that may not accurately represent pest abundances. After careful consideration, the recommended timing for baseline monitoring (November – December to coincide with peak pest activity) was deemed most appropriate for this study despite the potential of noise disturbances from C1 construction works in southern offset sites. The potential impact of construction noises during monitoring should be considered when interpreting baseline results from southern sites.

## 3.8 Logistics

### 3.8.1 Resource requirements

#### 3.8.1.1 Cameras

As per grid overlays, a total of 68 Reconyx Hyperfire 2 cameras (or cameras of a similar standard) will be required for a period of eight weeks each year. Two 32GB SD cards and 24 x AA batteries will be required for each camera to allow for SD card and battery swaps

throughout the monitoring period. Python locks (x 68) will be used to secure cameras at each station to reduce the possibility of theft.

#### 3.8.1.2 Lures

Lures will be placed at seven camera locations within the Woondum offset area. Olfactory lures (e.g. cat urine or chicken oil) will be encased within a small jar with a perforated lid attached to a wooden stake (≈ 30 cm from the ground) (as per Comer et al. 2018). Electronic sound emitters providing audio lures (e.g. distressed prey sounds or cat meows) will also be attached to the stakes. For this set-up, seven wooden stakes, seven electronic sound emitters, and seven jars will be required, along with an olfactory lure which will be replaced/topped up during fortnightly camera checks.

#### 3.8.1.3 Field work

Staffing requirements (i.e. person hours) for the deployment, checks, retrieval, and analysis of cameras are outlined in Table 3. Camera deployment will require two teams comprising two individuals for two days of deployment. Once deployed, SD cards, batteries, and lures will be checked and replaced where necessary by one team of two individuals on a fortnightly basis (i.e. 3 checks in total). Cameras will be retrieved after eight weeks of deployment by one team of two individuals. Accommodation will be required for camera deployment (one night for four individuals). The frequency of battery/SD card/bait checks will likely decrease in subsequent years if the equipment allows for it, though fortnightly checks will be done in the first year to ensure full functionality for baseline data collection.

Image analysis is estimated to take around 136 hours per monitoring period, allowing for two hours per camera trap. This may increase or decrease depending on the abundance of animals within offset clusters. The allocated time for baseline survey data analysis is approximately two days, though this will likely decrease over the life of the project as the process will become more efficient over time.

Table 3 Indicative annual person hours required for camera trap (CT) monitoring.

| Task | Week 1 (start) | Week 2 (end) | Week 4 (end) | Week 6 (end) | Week 8 (end) | Post-monitoring |
|---|---|---|---|---|---|---|
| **Camera deployment** | 68 CTs x 2 people per CT x 20 min per CT | | | | | |
| **Battery, SD card & lure checks** | | 68 CTs x 1 person per CT x 15 min per CT | 68 CTs x 1 person per CT x 15 min per CT | 68 CTs x 1 person per CT x 15 min per CT | | |
| **Camera retrieval** | | | | | 68 CTs x 1 person per CT x 10 min per CT | |
| **Image analysis** | | | | | | 68 CTs x 2 hr per CT |
| **Data analysis** | | | | | | ≈ 16 person hrs |
| **Total** | **≈ 45 person hrs** | **17 person hrs** | **17 person hrs** | **17 person hrs** | **≈ 11 person hrs** | **≈ 152 person hrs** |

### 3.8.2 Health Safety and Environment Plan

A site-specific Health Safety and Environment (HSE) Plan that complies with relevant occupational health and safety legislation and details how the safety of staff and other personnel will be managed throughout the monitoring period will be prepared prior to site mobilisation. The plan will include:

- HSE roles, responsibilities, and targets
- field team qualifications, inductions and permits required to conduct works
- vehicle and field equipment used on site and maintenance schedules, including daily vehicle and equipment inspections
- survey schedule that details time and location of all field activities
- job HSE analysis that assesses all potential hazards/risks associated with the field surveys, describes control measures required to manage those risks and assesses residual risks with controls in place
- safe work method statements for key hazards, including work in remote locations and working at night
- communications plan that documents:
  - communication equipment to be carried by the field team (e.g. vehicle and handheld UHF radio, military radio if required, satellite phone, mobile phone)
  - project personnel and emergency contacts
  - daily safety check-in procedures
  - emergency preparedness and response plan (including reporting of all incidents and near incidents to TMR)
- injury management plan
- vehicle journey management plan.

### 3.8.3 Contingency plan

In the event of extreme or prolonged adverse weather/events that may affect the detectability of pest species on cameras, surveys will be postponed until conditions are more optimal. Surveys will aim to occur within two weeks of scheduled timing to minimise the environmental variation between monitoring events (e.g. rainfall and temperature changes between months).

In the event that a camera fails to trigger due to technical issues, that camera will not be included in the data analysis. While this will decrease the sample size (i.e. number of cameras) of the study, it will not bias the results. The activity index is calculated based on the number of observations per camera per day, meaning that if a camera fails and is removed from the analysis, the result will still be a standardised measure of activity calculated from the observations of the remaining cameras.

In the event that zero pest animals are captured on cameras over the whole monitoring period,

detection dogs may be brought in to determine presence/absence of pest species. Data from detection dog surveys will not be statistically analysed and will serve solely to determine presence/absence of pest species in each offset cluster. If detection dogs are utilised, methods detailing how they were utilised, and the type of data collected will be documented in the annual report.

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# Appendix 1 Suitably qualified persons

| Name | Qualifications | Relevant experience |
|---|---|---|
| **Ellie Kirke**<br>Wildlife Biologist | Masters of Wildlife Health and Conservation, Murdoch University, current<br>Bachelor of Science (Zoology, Ecology), University of Queensland, 2017<br>Bachelor of Science (Honours), University of Queensland, 2018 | Ellie is a Wildlife Biologist with experience monitoring wildlife populations across Australia, including in the Northern Territory, Queensland, and Victoria. Ellie is well-versed in various fauna monitoring techniques including the use of cage, Elliott, pitfall and harp traps, motion sensing cameras and sound monitoring devices (e.g. call-playback). She has participated in various camera trapping programs for threatened and invasive species, including northern quolls, new holland mice, fox, feral cat, deer, and feral pigs in Victoria, South East Queensland, and Groote Eylandt. Ellie has conducted multiple koala surveys in the Otway Ranges using distance-sampling techniques to monitor population changes following mass die-off events resulting from over-abundance. She has also undertaken trials of new pig trapping technology with the Conservation Ecology Centre in Victoria. |
| **James Davis**<br>Wildlife Team Manager | Graduate certificate in Animal Science (Wildlife Biology), University of Queensland, current<br>Master of Business, The University of Notre Dame Australia, 2005 | James is a wildlife management consultant, animal behaviourist and ethologist specialising in vertebrate pest management, in particular canids. He is a professional conservation dog trainer / handler and runs a team of working spaniels trained to detect both invasive and cryptic native fauna species. James is passionate about pest vertebrate management as a means of protecting Australia's native wildlife and reducing human-wildlife conflict. While working for Ecosure, James has assisted in the preparation and implementation (active management) of a Dingo Management Plan for a mine site in Western Australia. He has also managed a detection dog project identifying fox dens, scats, and tracks for multiple sites across the Gold Coast. |
| **Jess Bracks**<br>Principal Wildlife Biologist | Bachelor of Applied Science in Animal Studies (Wildlife Biology), University of Queensland, 2005 | Jess is a Wildlife Biologist with 14 years' practical experience in the veterinary, zoo and consulting industries. She is passionate about driving pragmatic wildlife management policy; balancing the needs of community and conservation. Jess is often invited to advise on policy for local, state and federal government.<br>Jess has played pivotal roles in facilitating various multi-stakeholder groups with a focus on coordinated and strategic wildlife management and pest animal management at regional and national levels. Jess has prepared numerous pest animal management plans and programs and is often involved in on-ground monitoring and management. |
| **Dr. Katrin Lowe**<br>Ecologist | PhD (Ecology), Griffith University, 2013<br>Bachelor of Science (Honours), The University of Queensland, 2006<br>Bachelor of Science, The University of Queensland, 2004 | Katrin is a terrestrial Wildlife Ecologist with a passion for environmental conservation. She has developed an extensive and diverse skill set over the past 13 years, from many aspects of wildlife ecology and research. She has conducted field surveys on many fauna groups including amphibians, mammals, birds, reptiles, and fish and other aquatic fauna, both targeted threatened fauna surveys and general biodiversity surveys. Katrin also designed and implemented multiple koala SAT surveys and Rapid-SAT surveys, requiring identification of koala scats and scratch markings. She has also conducted various bird surveys, with a few including searches for BBBQ platelets. |

| Name | Qualifications | Relevant experience |
|---|---|---|
| **Nigel Cotsell**<br>Senior Ecologist | Masters of Natural Resources, University of New England, 2015<br>University of Queensland Masters Qualifier, 1993<br>Bachelor of Science, Australian National University, 1999 | Nigel is a Senior Ecologist with extensive experience in ecological assessments, threatened species, biodiversity strategic planning, SEPP44 and Koala Plans of Management. He has undertaken numerous SAT surveys, conducted camera trapping for koalas on Stewardship Sites, and has prepared and reviewed multiple Comprehensive Koala Plans of Management under the SEPP44. Nigel has worked across a range of policy, strategic planning and environmental legislation to deliver, with partners, a range of targeted threatened species and ecosystem management priorities that includes key elements of the NSW government's Saving our Species program. Nigel has also undertaken targeted BBBQ surveys for the Queensland Department of Environment and Heritage around Moogerah Peaks and Mt French. |
| **Dr. Rebecca Diete**<br>Wildlife Ecologist | PhD (Wildlife Ecology), The University of Queensland, 2017<br>Bachelor of Applied Science (Honours), The University of Queensland, 2010<br>Bachelor of Applied Science (Wildlife Science), The University of Queensland, 2009 | Rebecca is a Wildlife Ecologist with a background in threatened and invasive species research, wildlife monitoring and conservation, and natural resource management. She has extensive experience leading fauna surveys in various remote locations, particularly in northern Australia. Rebecca has conducted koala monitoring and predator monitoring on multiple Bush Heritage reserves in Central Queensland and has also worked under a Fitzroy Basin Association grant using citizen science to aid koala conservation in the central highlands. |
| **Dr. Natalie Toon**<br>Senior Environmental Scientist | Doctorate of Philosophy, Murdoch University, 2013<br>Bachelor of Science (Honours), University of Queensland, 2004<br>Bachelor of Science, University of Queensland, 2001 | Natalie is an Environmental Scientist has 15 years' experience managing and working on private enterprise, government and academic projects in both Queensland and Western Australia. She has a strong scientific background with experience in ecological and biological surveys, baseline data collection and reporting, ecological data management and statistics. Natalie has completed multiple koala surveys and has developed and delivered koala Offset Management Plans for Queensland's Department of State Development. |
| **Heather Richards**<br>Senior Environmental Scientist | Masters in Environmental Management (Sustainable Development), University of Queensland, 2012<br>Bachelor of Marine Studies, in Coastal Management, University of Queensland, 2005 | Heather is a Senior Environmental Scientist with over 15 years of experience in both the public and private sector. Heather assisted in the development of a BBBQ Habitat Restoration Plan for Queensland Alumina Limited in 2014 and has been conducting on ground management since that time, updating the plan when necessary. On ground work has been assisted by other Ecosure field ecologists and has included camera monitoring during the BBBQ peak breeding season. Heather has also assisted in the development and delivering of koala Offset Management Plans for RioTinto Offset properties and has conducted multiple koala surveys alongside Ecosure field ecologists. |
| **Jen Ford**<br>Principal Restoration Ecologist | International Ecological Restoration Certification<br>Certificate IV – Bushland Regeneration, North Coast Institute of TAFE<br>Certificate IV – Workplace Assessment and Training, North Coast Institute of TAFE | Jen Ford is Ecosure's Principal Restoration Ecologist with over 24 years' experience restoring a wide range of ecosystems across South East Queensland, Central Queensland and northern New South Wales. Jen has developed hundreds of practical ecological restoration plans including plans that are guiding the recovery of BBBQ habitat on a number of sites.<br>Jen manages a team of 40 knowledgeable and experienced scientists that are currently working on more than 30 sites where ecological restoration is improving the habitat and connectivity for koalas. In December 2018, they completed Queensland's largest koala restoration project including the design, implementation, maintenance and monitoring of a 206 ha area in Ripley. The team regenerated 65 ha of key habitat and planted a further 141 ha with 114 000 koala food and shelter trees. The site is now at a point of minimal maintenance as recovery continues. |

| Name | Qualifications | Relevant experience |
|---|---|---|
| **Cameron Radford**<br>Senior Ecologist | Doctorate of Philosophy, University of NSW, current<br>Masters of Wildlife Health and Population Management, University of Sydney, 2010<br>Bachelor of Science (Biology and Ecology), University of Sydney, 2009 | Cam is a highly qualified Wildlife Biologist with over 12 years' experience in ecological consultancy and wildlife conservation research. Cam has extensive experience conducting biodiversity impact assessments, threatened species targeted surveys and monitoring, species reintroductions, wild canid taxonomy research, threatened species threat abatement, and species reintroduction and management plans. Cam has undertaken numerous koala surveys utilising a range of monitoring techniques including SAT surveys, radio-tracking, spotlight surveys, call-playback surveys, and koala feed tree surveys. He has also recently developed a Comprehensive Koala Plan of Management. Cam has monitored introduced predators via spoor transect surveys and camera trap surveys in semi-arid regions in NSW and south-east Australia. He has also monitored African predators including lion, African wild dogs, spotted hyena and leopard through VHF and satellite tracking, call-playback surveys, spoor transect surveys, and camera trap monitoring. |

# Ellie Kirke

## Graduate Wildlife Biologist

Ellie Kirke joined the wildlife team in July 2019 as the Graduate Wildlife Biologist. Prior to this she received first class honours from the University of Queensland for her study on the northern quoll on Groote Eylandt. She has extensive experience in surveying and monitoring wildlife populations across Australia, including in the Northern Territory, Southeast Queensland, South Victoria and East Gippsland. Her prior experience has mainly involved native mammal species, though she holds a strong interest in all classes of flora and fauna.

Prior to working for Ecosure, Ellie completed a three-month internship at the Conservation Ecology Centre in Cape Otway, Victoria, where she gained knowledge of conservation practices, fire ecology and feral species management. She also completed a short-term contract as a field ecologist with Wildlife Unlimited, monitoring vulnerable populations of New Holland mice in Bairnsdale, East Gippsland. Ellie brings valuable field, data analysis and writing skills to the team, along with an energised passion for threatened species conservation.

Since being at Ecosure, she has developed a keen interest in human-wildlife conflict management and has contributed to projects involving black-backed gulls, dingoes, macropods and Australian white ibis. Ellie has a particular interest in wildlife health and disease ecology and is currently completing postgraduate studies in this field.

Ellie has experience in:

- fauna monitoring techniques
    - cage, pitfall and harp trapping
    - motion sensing camera and sound monitoring
- terrestrial flora and fauna surveys
    - koala surveys (using distance sampling)
    - habitat assessments
- data analysis and reporting
- animal handling

## Qualifications

Bachelor of Science (Honours) Majoring in Zoology and Ecologist, University of Queensland, 2018

Master of Wildlife Health and Conservation, Murdoch University, current

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# Project experience

| Date | Project | Client | Project Position | Role |
|---|---|---|---|---|
| **Mining, Energy & Natural Resources** | | | | |
| 2020 | Woodie Woodie Dingo Management Plan | Consolidated Minerals Pty Ltd | Project support/Wildlife Biologist | Assisted in drafting the Dingo Management Plan and provided general project support. |
| **Government** | | | | |
| 2020 | Deer Monitoring (2 x projects) | Brisbane City Council | Project Manager<br>Field lead and author | Deployed fifteen motion-sensing cameras for a period of four weeks to monitor the movements of rusa, fallow, and red deer along movement corridors. Undertook field work, analysis of camera trap data, and compiled reports for two projects. |
| 2020 | Fox Natal Den Detection in Natural Areas | City of Gold Coast | Project support<br>GIS analyst<br>Wildlife Biologist | Assisted in the analysis of dog detection tracks, GIS mapping and compilation of data into summary report for the client. |
| 2019-2020 | Seagull Management Plan | Sydney Harbour Federation Trust | Project support<br>Wildlife Biologist | Conducted site assessments and monitored seagull populations at three heritage-listed sites around Sydney. Assisted in drafting the Seagull Management Plan. |
| 2019-2020 | Macropod Conservation Plan | Sunshine Coast Council | GIS analyst<br>Wildlife Biologist | Conducted GIS and excel analyses for the Macropod Conservation Plan that aimed to ensure the sustainability of eastern grey kangaroo and other macropod populations across the Sunshine Coast LGA. |
| 2019 | Species Management Program - Australian White Ibis<br>Varsity Lakes to Tugun M1 Upgrade | Department of Transport and Main Roads | Lead author<br>GIS analyst<br>Wildlife Biologist | Conducted a site assessment to assess the Australian White Ibis population at a road verge intended to be cleared as part of the M1 upgrade from Varsity Lakes to Tugun. Primary author of the Species Management Plan, including GIS mapping. |
| **Airports** | | | | |
| 2020 | Black-backed Gull Management Program; Movement Study Report | Wellington International Airport Limited | Project support<br>GIS analyst<br>Wildlife Biologist | Assisted in Stage 2 of the program, involving the analysis of a years-worth of black-backed gull tracking data and compilation of the movement study report. Analysis involved the use of ArcGIS, R programming and Excel. |
| 2019 - current | Terrestrial Fauna Monitoring | Gold Coast Airport Pty Ltd | Field scientist | Conducted surveys and prepared reports for microbat, birds and frogs at the airport as part of the environmental management plan. |
| 2019 | Peregrine Falcon Risk Assessment and Management Plan | Qantas Airways Limited | Lead author/ Wildlife Biologist | Primary author in the preparation of the Peregrine Falcon Management Plan at, in response to swooping incident involving a contract worker at Sydney International Airport. |
| **Other relevant consulting experience** | | | | |
| 2019 | New Holland Mouse Population Monitoring | Zoos Victoria | Field Ecologist | Conducted two weeks of trapping (Elliot traps) to monitor the population of new holland mice in East Gippsland. |
| 2019 | Camera trap data analysis | Conservation Ecology Centre | Ecologist | Sorted through approximately 50,000 camera trap images for client that was creating an automated camera trap identification program. |
| 2019 | Ecological field surveys | Conservation Ecology Centre | Field Ecologist | Conducted various surveys including acoustic frog surveys, koala surveys, threatened vegetation surveys, camera trap surveys and feral pig monitoring. |

## Training

- Bachelor Degree with Honours – Science (Zoology and Ecology)
- CPR
- First Aid
- Venomous Snake Handling
- Driver Licence

# James Davis

## Wildlife Manager

James is a wildlife management consultant and has led Ecosure's wildlife team since January 2019. Prior to this, he has worked in both wildlife consultancy and practical field operations, bringing a diverse skillset to the Ecosure team. James is also a PRINCE2-qualified project manager with extensive experience in risk assessment and managing wildlife projects globally.

James originally studied Environmental Management at the University of Notre Dame Australia, before spending a number of years working as an Australian Diver Accreditation Scheme (ADAS)-qualified commercial diver on scientific and media projects around the world, including BBC's Planet Earth. More recently James has focused on wildlife management and developing specialist skills such as conservation detection dog training and handling, chemical immobilisation (darting) and wildlife disease/biosecurity surveillance.

James is passionate about pest/feral/invasive vertebrate management as a means of protecting Australia's native wildlife and reducing human-wildlife conflict. His work focusses on combining scientific rigour with effective fieldcraft to achieve strong outcomes. James brings a wealth of knowledge from his diverse background to the company and is an integral part of the wildlife team.

James has experience in:

- Project management
- Vertebrate pest management
- Conservation detection dog training / handling
- Wildlife disease / biosecurity surveillance
- Chemical immobilisation (darting)
- Scientific diving
- Terrestrial and marine fauna surveys
- Fauna spotter catching and wildlife relocation
- GIS mapping

## Qualifications

Graduate certificate in Animal Science (Wildlife Biology), University of Queensland, current

Master of Business, The University of Notre Dame Australia, 2005

ADAS Part Two Commercial Diver, The Underwater Centre Fremantle, 2004

## Professional memberships & associations

Member, Australasian Wildlife Management Society (AWMS)

Member, Ecological Society of Australia (ESA)

Member, Wildlife Health Australia (WHA)

Member, Australasian Conservation Dog Network (ACDN)

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## Training

- Venomous Snake Handling
- 4WD Driving & Recovery
- First Aid
- CPR

## Licences

- Construction Card
- Firearms Licence - Parts A & B
- Concealable Firearms Licence - H
- ADAS Part Two Commercial Diving
- Rehabilitation Permit - Fauna Spotter Catcher QLD

## Qualifications

Bachelor of Applied Science in Animal Studies (Wildlife Biology), University of Queensland, 2005

## Professional memberships & associations

Co-convener of the Flying-fox Expert Group, Australasian Bat Society

Member, The Wilderness Society

Member, Australian Geographic

Member, Australasian Wildlife Management Society

Member, Wildlife Health Australia Bat Focus Group

Member, Bat Conservation and Rescue Qld

# Jess Bracks

## Principal Wildlife Biologist

Jess is a Wildlife Biologist with 15 years' practical experience with wildlife through positions in the veterinary, zoo and consulting industries. During this time, she has had extensive experience surveying wildlife using a variety of terrestrial and aquatic techniques. Jess has been an integral part of Ecosure's wildlife consulting team since 2009.

Jess is passionate about threatened species recovery and conservation. She has developed and implemented management plans for a wide range of threatened fauna with demonstrated successful outcomes for local, state and federal government as well as the private and resource sectors.

Jess has played pivotal roles in facilitating various multi-stakeholder groups with a focus on coordinated and strategic wildlife management at regional and national levels. Jess co-convened the inaugural National Flying-fox Forum, run annually since 2016. These events are sponsored by state and federal government and attended by delegates from all levels of government, research and conservation sectors across Australia. She is often invited to advise on government policy, including as an expert witness in the 2016 Parliamentary Inquiry into the management of nationally protected flying-foxes in the eastern states of Australia.

Jess has experience in:

- Fauna surveys and habitat assessment
- Threatened species monitoring
- Human/wildlife risk assessment and conflict management
- Project management
- Scientific writing
- State and federal permit application and management
- Community and stakeholder engagement
- Fauna spotter catching and wildlife relocation
- Preparation of Environmental Management Plans
- Animal health and disease

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# Project experience

| Date | Project | Client | Project Position | Role |
|---|---|---|---|---|
| **Mining, Energy & Natural Resources** | | | | |
| 2020 | Dingo conservation and risk mitigation | Consolidated Minerals | Wildlife Biologist | To assess the risk to personnel associated with dingoes at a mine site, and develop a management program to monitor the population, mitigate risk to personnel and conserve dingoes along with their ecological and cultural values. |
| 2011 - 2012 | Shorebird surveys as part of Environmental Management Plan | Coffey Environments | Project manager and field biologist | Jess undertook shorebird surveys to monitor changes in species composition, abundance and habitat use associated with LNG development. Reporting requirements include assisting the development of a shorebird monitoring plan, along with ensuring compliance with Environmental Management Plans and state/federal permit conditions. |
| 2011 - 2013 | Shorebird surveys as part of LNG pipeline development | McConnell-Dowell Joint Venture | Project manager and field biologist | Jess undertook shorebird surveys for several years to monitor shorebirds at internationally important roost and foraging sites in the Gladstone area. The program included reporting on population trends and recommending mitigation measures to prevent impacts as required. |
| **Government** | | | | |
| 2018 - 2020 | Little red flying-fox management review | CSIRO / Qld Department of Environment and Heritage Protection | Project manager, lead author | To review camp management in Queensland and the effectiveness of these activities, and develop tools to assist EHP provide advice to local government. |
| 2019 | Flying-fox habitat restoration program and camp mapping | Local Government NSW | Project Manager, technician, reporting | To assess NSW flying-fox camps for their restoration potential from a conflict mitigation and conservation perspective, to help prioritise sites for a ten-year, $5M program of flying-fox habitat restoration. |
| 2019 | Flying-fox foraging habitat modelling | Local Government NSW | Technical support | Partnered with Dr Peggy Eby and GIS specialists to model flying-fox foraging habitat across NSW, updating the 2008 Eby and Law model. |
| 2018 - 2019 | Dog and animal hazard management | Ministry of Communications and Transport, Government of Tuvalu (supported by the World Bank) | Project manager, training, field | Revision of the existing wildlife management program along with an engaging community education program is required to mitigate this risk. |
| 2016 and 2018 | Flying-fox camp habitat research (2016)<br>Flying-fox camp habitat modelling (2018) | Office of Environment and Heritage | Project manager and author | Ecosure was engaged by the NSW OEH to research the feasibility of restoring and creating flying-fox roost habitat in or near contentious camps in NSW, developing a tool for land managers to map potential habitat and prioritise potential roost sites against key criteria. This was followed by a second project to model and map likely flying-fox habitat and potential conflict sites across the state. |

| Date | Project | Client | Project Position | Role |
|---|---|---|---|---|
| 2011 - 2020 | Flying-fox monitoring and management (various) | **Federal**<br>National Landcare Program Grant (partner)<br>CSIRO<br>**State**<br>Qld Department of Environment and Science<br>NSW Office of Environment and Heritage<br>Local Government Association of Qld<br>Local Government Association of NSW<br>**Qld local govt**<br>City of Gold Coast, Brisbane City, Redland City, Logan City, Sunshine Coast, Noosa, Moreton Bay Regional, Scenic Rim Regional, Mt Isa City, Toowoomba Regional, Hinchinbrook, Gympie Regional, Isaac Regional, Ipswich City, Townsville<br>**NSW local govt**<br>Campbelltown City, Pittwater Council, Manly, Northern Beaches, Tamworth Regional, Nambucca Shire, Liverpool City, Bellingen Shire, Armidale Regional, Wollondilly Shire, Eurobodalla Shire, Port Macquarie Shire, Cessnock City<br>**Vic local govt**<br>Colac Otway Shire<br>**ACT**<br>National Capital Authority | Project manager, field lead, plan author | Jess has monitored flying-fox roosts around Australia, developing and implementing management programs to manage community impacts, while providing for flying-fox protection and conservation. Jess has liaised with state and federal government, being asked to contribute to flying-fox management policy. She appreciates the value of stakeholder consultation and community engagement, and has facilitated various workshops regarding flying-fox conservation and management. |
| 2018 | Osprey Species Management Program | City of Gold Coast | Project advisor | Jess provided advice regarding best methods for nest relocation and animal welfare. |
| 2017 | Townsville City Biosecurity Plan | Townsville City Council | Technician | Jess was the lead pest animal management author for the Biosecurity Plan under the recently enacted Biosecurity Act, which included stakeholder consultation and a comprehensive plan to manage biosecurity risks across the local government area. |
| 2016 | Flying-fox camp management plan expanded template | Office of Environment and Heritage | Project manager and author | Together with OEH Jess developed an expanded camp management plan template to assist land managers mitigate impacts from flying-fox camps, while providing for flying-fox conservation. |
| 2016 | Brush-tailed Rock Wallaby Surveys and Habitat Restoration | Ipswich City Council | Field and plan author | Following field surveys of brush-tailed rock wallaby habitat a plan was developed to guide resource allocation to the most effective and prioritised habitat restoration and improvement actions. |
| 2013 | Flying-fox information Guide | Local Government Association of Queensland | Project manager and lead author | Jess produced a flying-fox Information Guide for Local Government Association of Queensland to provide to councillors and mayors across Queensland detailing information on flying-foxes, risk and management options to allow councils to develop effective responses to community concerns. |

| Date | Project | Client | Project Position | Role |
|---|---|---|---|---|
| 2013 | Koala population surveys | City of Gold Coast | Field and technical support | Surveys included detailed Spot Assessment Technique (SAT) sampling and transect searches, as well as koala survey method training from Dr Steve Phillips |
| 2012 | Fraser Island Dingo Management Strategy Review | Department of Environment and Heritage Protection | Project manager and lead author | Fraser Island Dingo Management Strategy Review for the Department of Environment and Heritage Protection to ensure sustainability of the dingo population and reduce risk to humans. |
| 2011 - 2012 | Introduced Predator Control as part of the Long-nosed Potoroo Management Plan | SMEC on behalf of Department of Transport and Main Roads | Project manager | Fox and wild dog management as part of the Long-nosed Potoroo Management Plan for the Tugun Bypass, including monitoring, trapping and baiting |
| 2010 | Management plan for cattle egrets | Sunshine Coast Regional Council | Project manager | Involved consultation with federal and state environment departments, permitting, monitoring, selective egg and nest removals and reporting. |
| **Airports** | | | | |
| 2009 - current | Threatened Species Monitoring | Gold Coast Airport | Project Manager, Wildlife Biologist | Threatened fauna monitoring and conservation for Gold Coast Airport including monitoring common planigale (*Planigale maculata*) using pitfall traps, wallum froglet (*Crinia tinnula*) and wallum sedge frog (*Litoria olongburensis*) with call playback and various microbat spp. with harp traps and ANABAT detectors. |
| 2018 - 2020 | Black-backed gull tracking and management | Wellington International Airport | Project manager, stakeholder consultation and field | The Ecosure/Avisure Group was engaged to develop and implement a program to mitigate risk associated with the most commonly struck species, the Black-backed Gull (*Larus dominicanus*). The adopted program centres around a multi-faceted and multi-stakeholder approach includes a three-stage approach of an Interim Management Plan; Movement Study; Improved Risk Mitigation. |
| 2013 | Straw necked ibis radio tracking study | Brisbane Airport Corporation | Project manager and field lead | Six individuals were fitted with radio transmitters, and tracked for six weeks to determine their movement patterns. This data informed recommendations provided to Brisbane Airport to assist minimising the bird strike hazard presented by this species. |
| **Roads & Construction** | | | | |
| 2015 - current | Microbat monitoring and mitigation – Woolgoolga to Ballina Highway Upgrade | CMC Group (on behalf of Roads and Maritime Services) | Field | Threatened microbats (including *Myotis macropus* and *Miniopterus spp*) occur in the project footprint. Jess monitors Ecosure-installed roost boxes, and is implementing additional measures to avoid impacts during construction (including exclusion from bridges/culverts prior to demolition). |
| 2014 | Mona Vale Road upgrade – Biodiversity investigation | Roads and Maritime Services | Field | Jess assisted with field surveys for microbats (harp traps and detectors), nocturnal surveys, active diurnal searches and installation of nest boxes for the threatened pygmy possum (*Cercartetus nanus*). |
| 2013 | Microbat relocation | Department of Transport and Main Roads | Project manager and field lead | Jess developed and implemented a Species Management Program to protect a maternity roost of large-footed myotis (*Myotis macropus*) during a road upgrade, and avoid impact to nesting welcome swallows (*Hirundo neoxena*). Included consultation with Department of Environment and Heritage Protection, excluding microbats from a culvert due to be decommissioned, removing swallow nests and supervision of construction works. |

| Date | Project | Client | Project Position | Role |
|---|---|---|---|---|
| 2011 | Microbat relocation and fairy martin impact mitigation | Department of Transport and Main Roads | Project manager and lead field | Jess implemented a fairy martin Species Management Program (SMP), and development and implementation of a SMP to protect a maternity roost of large-footed myotis (*Myotis macropus*) during a road upgrade. Includes consultation with DERM, microbat relocation, supervision of construction works, nest box installation and monitoring. |
| **Other relevant consulting experience** | | | | |
| 2011 - 2012 | Threatened fauna surveys | Granada Productions | Field and technical support | Jess conducted surveys for threatened microbats and frogs as part of Environment Management Plan for client. |

# Training

- Bachelor Degree
- CPR
- First Aid
- 4WD SRODRV001B
- Applied Project Management
- Effective People Management
- Fauna Forensics – Greening Australia
- Jeff's Orienteering Course
- Legal Review Training
- Venomous Snake Handling
- Venomous Snake Relocation
- Animal Ethics – Animal Care and Use
- Humane Euthanasia
- Flying-fox Rescue and Rehabilitation
- Koala habitat tree identification

# Licences

- Construction Card
- Driver Licence
- Rehabilitation Permit (Fauna Spotter Catcher QLD)
- Blue card – Industry Safety Induction

# Volunteering

- Bat rescuer, Bat Conservation and Rescue Queensland, 2019-current
- Field assistant, flying-fox catching for One Health research, Griffith University, February 2020
- Field assistant, radio tracking koalas for dog detection trials, 2012
- Field assistant, northern hairy-nosed wombat recovery program, 2011

- Field assistant, Platypus Watch field surveys, Gold Coast Catchment Association, 2011

## Conferences

- Australasian Wildlife Management Society Conference 2019, Darwin
- National Flying-fox Forum 2019, Canberra (Co-convener and facilitator)
- Humane Dog Population Management 3rd International Conference 2019, Kenya (Presenter)
- Pest and Weeds Symposium 2019, Gold Coast (Presenter)
- National Flying-fox Forum 2018, Cairns (Co-convener and facilitator)
- Australasian Wildlife Management Society Conference 2018, Hobart
- Australasian Bat Society Conference 2018, Western Sydney University
- National Flying-fox Forum 2017, Sydney (Co-convener and facilitator)
- National Flying-fox Forum 2016, Brisbane (Co-convener and facilitator)
- Australasian Bat Society Conference 2016, Hobart
- THECA Forum 2015, Conservation Conundrums: Exploring Apparent Conflicts in Wildlife Management, Brisbane (Presenter)
- QLD Pest Animal Symposium 2010, Gladstone
- Advanced Animal Learning Seminar 2007 Taronga Zoo, Sydney

## Awards and Nominations

- Nominated for the Australasian Wildlife Management Society Practitioner Award 2017, Australasian Wildlife Management Society
- Nominated for the Gold Coast Environmental Achievement Award 2015, City of Gold Coast
- Gold-Tailed Gecko Award 2015 in recognition of ethical wildlife management, Gecko Environment Council Association Inc.

## Publications and presentations

Bracks, J, Eby, P and Sims, R, 2019 'Flying-fox habitat modelling', Conference presentation, *National Flying-fox Forum*, Canberra.

Bracks, J and Treadwell-Kerr, M, 2019 'Australasian Bat Society Flying-fox Expert Group Update', Conference presentation, *National Flying-fox Forum*, Canberra.

Bracks, J, Shaw, P, Allen, B.L., Davis, J and McKee, J, 2019 'Ethical management of human-derived conflict with wild and domestic dogs: case studies from Oceania', Conference presentation, *3rd International Dog Population Management Conference*, Mombasa, Kenya.

Bracks, J, Hatfield, E, McKee, J and Shaw, P, 2019 'Managing human/flying-fox conflict in Australia', Conference presentation, *18th International Bat Research Conference*, Thailand.

Bracks, J, Galbraith, B, Whelan, J and Curley, B, 2019 'Feral Rusa Deer and Community Engagement in the Gympie Region', Conference presentation, *Pest Animal and Weeds Symposium*, Gold Coast.

Bracks, J and Treadwell-Kerr, M, 2018 'Australasian Bat Society Flying-fox Expert Group Update', Conference presentation, *National Flying-fox Forum*, Cairns.

Bracks, J and Treadwell-Kerr, M, 2018 'Australasian Bat Society Flying-fox Expert Group Update', Conference presentation, *Australasian Bat Society Conference*, Sydney.

Bracks, J and Collins, R, 2017 'Implementation of the EIANZ National Flying-fox Strategic Vision', Conference presentation, *National Flying-fox Forum*, Sydney.

Bracks, J and Roache, M, 2017 'Flying-fox Camp Habitat Research', Conference presentation, *National Flying-fox Forum*, Sydney.

McKee J, Bracks J, Wimberley T, Lenz M, Head N, Gerrard J, and Shaw P, 2016 'Emerging zoonosis risk management with radical *Understorectomy*', Conference paper, *New Zealand Veterinary Association 2016 Worlds in Fusion Conference*, Hamilton.

Ford, G, Lanham, E, Free, C, Bracks, J and Benton, N, 2016, 'Planes, bats and automobiles: what's happening with microbats at the Gold Coast Airport?' Poster Presentation, *Australasian Bat Society Annual Conference*, Hobart.

Allen, B.L, Higginbottom, K, Bracks, J.H, Davies, N & Baxter G.S. 2015 Balancing dingo conservation with human safety on Fraser Island: the numerical and demographic effects of humane destruction of dingoes, *Australasian Journal of Environmental Management*, 22 2: 197-215.

Bracks, J, 2015 '*The rigid dichotomy between humans and flying-foxes',* Conference presentation at *THECA Forum May 2015: Conservation Conundrums: Exploring Apparent Conflicts in Wildlife Management*, QCAT, Pullenvale.

Bracks, J, 2015 'Flying-fox management – Outcomes of a new framework', Presentation, *Local Government Association of Queensland Forum*, Quest, Breakfast Creek.

Shaw, P, and Bracks, J, 2013 'Flying-foxes: Fact, fiction and management', Presentation, *Local Government Association of Queensland Annual Conference*, Cairns.

Bracks, J, and Hetherington, S, 2013 'Flying-fox information kit for elected members', Local Government Association of Queensland.

McKee J, Boswell J, Bassett J, Wimberley T, Lenz M, Head N and Shaw P, 2011 'Hendra virus (HeV) spill-over: risk assessment, risk mitigation and risk fallout', Presentation, *Proc Australasian Wildlife Disease Association Conference*, Coorong SA 25th-30th September 2011.

Ferguson, GF and Boswell, J, 2010 'Sustainable Management of Native Wildlife – Australian White Ibis: a Case Study', *Qld Pest Animal Symposium*.

# Katrin Lowe

## Ecologist

Katrin Lowe is a terrestrial wildlife ecologist with a passion for environmental conservation. She has developed an extensive and diverse skill set over the past 13 years, from many aspects of wildlife ecology and research. She has conducted field surveys on many fauna groups including amphibians, mammals, birds, reptiles, and fish and other aquatic fauna, both targeted threatened fauna surveys and general biodiversity surveys. Her ecological research and field work experience has taken her to many habitats throughout Australia and internationally. Working with many different research and survey teams, she has acquired a strong understanding of ecological systems and processes. Katrin has worked with a variety of stakeholders across government, industry, academia, and community groups.

She conducted a large-scale research project on coastal wallum frog species of eastern Australia for her PhD at Griffith University. This allowed her to develop project management skills, survey design and implementation, and to specialise in identification of acid frog species.

## Qualifications

PhD (Ecology), Griffith University, 2013

Bachelor of Science (Honours), The University of Queensland, 2006

Bachelor of Science, The University of Queensland, 2004

## Areas of expertise

Terrestrial Ecology

Amphibian surveys

Wallum frog specialist

General fauna biodiversity surveys

Katrin has experience in:

- field surveys, data collection and species identification
- data collection, analysis, and reporting
- ecological data management and statistics
- terrestrial ecology
- wallum/acid frog surveys and identification
- koala SAT surveys
- targeted threatened species surveys
- *Environment Protection and Biodiversity Conservation Act 1999* requirements.

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# Project experience

| Date | Project | Client | Project Position | Role |
|---|---|---|---|---|
| **Fauna monitoring and biodiversity surveys** | | | | |
| 2019 | Koala SAT surveys | Ecosure Commercial in confidence | Ecologist, Project manager | Design and implementation of multiple Koala SAT surveys and Rapid-SAT surveys, requiring identification of koala scats and scratch markings. |
| 2019 | Water mouse surveys | Ecosure, commercial in confidence | Ecologist | Water mouse (*Xeromys myoides)* surveys to inform a development application in Booral Queensland. Five nights of Elliot and camera trapping in mangrove habitat. |
| 2019 | Environmental desktop assessments | Department of Transport and Main Roads | Ecologist, Ecosure | Environmental Scoping Reports identifying environmental constraints for a proposed cycleway. |
| 2019 - current | Various environmental projects | Ecosure | Ecologist | Assisting with reporting for environmental management plans, environmental impact assessments, and ecological surveys. |
| 2019 - current | Fauna Spotter Catcher | Ecosure, commercial in confidence | Ecologist, Fauna Spotter Catcher | Preclearance surveys identifying fauna habitat for large scale project clearing of boundary lines and fire breaks. Fauna spotter catcher services during clearing works. |
| 2012 – 2018 | Monitoring threatened species, wallum frogs | EcoSmart Ecology, Commercial in confidence | Field Ecologist | Field surveys of threatened wallum frog species at various development sites in the Sunshine Coast. Undertaking visual and acoustic frog surveys. |
| 2018 | Platypus habitat survey, Sunshine Coast powerline easement | EcoSmart Ecology | Field Ecologist | Surveying and assessing platypus habitat for powerline easement upgrade. |
| 2016-17 | Threatened species monitoring | EcoSmart Ecology, Commercial in confidence | Field Ecologist | False antechinus (*Psuedantichinus mimulus*) and Purple-necked rock wallaby (*Petrogale purpureicollis*) surveys at a mine site near Cloncurry, QLD. Elliot trapping for small mammals and installing baited camera traps for rock wallabies and pest carnivores. |
| 2017 | Monitoring threatened species: wallum frogs | Ausecology Commercial in confidence | Field Ecologist | Fauna field ecologist surveying threatened wallum frog species at sand mining sites on North Stradbroke Island. |
| 2016 | Fauna Spotter Catcher | Ausecology, Lendlease road upgrade | Fauna Spotter Catcher | Fauna Spotter Catcher for motorway upgrade, including pre-clear surveys and fauna handling and relocation. |
| 2016 | Biodiversity surveys - fauna | EcoSmart Ecology, Commercial in confidence | Field Ecologist | Large scale general biodiversity surveys for birds, mammals, reptiles, amphibians, bats at coal seam gas mine sites in Dalby/Miles area. Establishing trapping sites utilising Elliot traps, cage traps, pitfall trapping, harp trapping and camera trapping. Also conducting nocturnal fauna searches and bird surveys. Some surveys including targeted black-breasted buttonquail surveys. |
| 2014 | Standard Biodiversity Surveys for declining small mammals in the Northern Territory Top End | Department of Land Resource Management, Northern Territory: Terrestrial Ecosystems | Scientist | Multiple field surveys using pitfall, Elliot and cage traps targeting small mammals and herpetofauna, as a part of standard biodiversity surveys with the National Environmental Research Program. Field prep and data and equipment management and working in remote areas with 4WD and ATVs. Working with scientists and indigenous rangers surveying declining small mammal populations in the Northern Territory Top End. |

| Date | Project | Client | Project Position | Role |
|---|---|---|---|---|
| **Academic research and field work** | | | | |
| 2008 - 2013 | Ecology of the wallum sedge frog (*Litoria olongburensis*) in eastern Australia | Griffith University | Researcher and Project Manager (PhD) | Large scale study into the ecology and bioclimatic conditions of the wallum sedge frog (*Litoria olongburensis*) in coastal wallum wetlands of eastern Australia. Designed and conducted two years of visual and acoustic frog surveys throughout the distributional range of *L. olongburensis*. Project management: organising volunteers and extensive travel for field surveys, maintaining a large database, completing sophisticated statistical analyses, writing multiple scientific papers. Communicating to government agencies and the broader community. |
| 2014 | Avian malaria research project | Griffith University | Research Assistant | Assisting with mist netting birds in New Caledonia. |
| 2013 | Conservation in Practice, Nepal: fauna surveys | Griffith University | Field surveys supervisor and tutor | Leading and undertaking pitfall, Elliot trapping for small mammals and herpetofauna, and bird surveys in Chitwan National Park, Nepal. |
| 2010, 2011, 2012 | Lake Broadwater fauna surveys | Griffith University | Field surveys supervisor and tutor | General fauna surveys Lake Broadwater, Dalby, QLD Long Term Ecological Research sites. Fauna surveys for birds, mammals, frogs, and reptiles. Establishing fauna trapping sites using Elliot, cage, and pitfall traps, as well as nocturnal searches. |
| 2012, 2013 | Bowra Fauna surveys | Griffith University | Field surveys supervisor and tutor | General fauna surveys Bowra Wildlife Sanctuary, Cunnamulla, QLD. Fauna surveys for birds, mammals, frogs, and reptiles. Establishing fauna trapping sites using Elliot, cage, and pitfall traps, as well as nocturnal searches. |
| 2010 | Currawinya National Park site establishment | Griffith University | Field Assistant | General fauna surveys Currawinya National Park, QLD. Establishing long term ecological research sites. |
| 2007 | Local Government and Health in a Climate of Change | Griffith University, Urban Research Project | Research Assistant | Preparing reports and book chapters on the effects of climate change on human health. |
| 2005 - 2006 | Ecology of the Lamington spiny crayfish (*Euastacus sulcatus*) | The University of Queensland | Research (Honours) | Honours research on the thermal ecology of the Lamington spiny crayfish and assessing vulnerability to global climate change. Radio tracking large freshwater crayfish and assessing thermal ecology with temperature data loggers. |
| **Relevant not-for profit and volunteer experience** | | | | |
| 2015 - 2019 | Wolston and Centenary Catchments | Wolston and Centenary Catchments | President | Engaging with the community through planting and weeding days, throughout south-west Brisbane catchments. Successfully received multiple state and local government grants for multiple bushland regeneration projects throughout the catchments. Chairing general meetings and liaising with local council, contractors, and the local community. Focusing on supporting native flora and fauna and improving connectivity of native wildlife corridors and bringing environmental awareness to the community. Winners of the Lord Mayor's Australia Day Green Heart Award 2019. |
| 2013 | Operation Wallacea - Indonesia | Operation Wallacea | Lead Herpetologist | Lead Herpetologist on the annual wildlife surveys on Buton Island, Sulawesi Indonesia. Established pit fall trapping sites for two months of small terrestrial fauna surveys with the aid of local guides, ensuring rigorous adherence to previous scientific protocol. Organised volunteers, undergraduate students and worked with local guides and Indonesian University students. |

| Date | Project | Client | Project Position | Role |
|---|---|---|---|---|
| 2011 | PlatypusWatch | Wildlife Preservation Society of Queensland | Platypus surveys | Participated in the annual PlatypusWatch surveys located at multiple creeks throughout Brisbane. |
| **Bushland rehabilitation** | | | | |
| 2018-2019 | Skilling Queenslanders for Work | Multicultural Development Australia | Field Supervisor | Overseeing on ground bushland regeneration works at multiple sites in the Wolston and Centenary Catchments, Brisbane. Supervised trainees from disadvantaged and culturally and linguistically diverse backgrounds undertaking a Certificate 1 in Conservation and Land Management. |
| 2018-2019 | Bushland regeneration | Wolston and Centenary catchments | Project manager | Weeding and planting with community bushcare groups focussing on rehabilitation and restoration of riparian areas throughout Brisbane. Liaising with contractors and council for on ground rehabilitation works to make sure we reach milestones within the budget. |

# Training

- 4WD Training Course
- Venomous snake handling course 2016
- Media and Communications training for bushcare groups, Wombat Creative, 2016
- CPCCOHS1001A - Work Safely in the Construction Industry, White card 2015
- ATV – All terrain vehicle off road quad bike training 2014
- Fauna Spotting and Handling Workshop 2016
- Apply First Aid, CPR and Basic life support 2019
- Experimental Design and Statistics 2010, Griffith University

# Licences

- Queensland Driver Licence (Car, Manual)

# Publications and presentations

**C1. Refereed Publications / International Journals:**

**Lowe K**, Castley G, & Hero J-M (2016) Calling phenology and detectability of a threatened amphibian (Litoria olongburensis) in ephemeral wetlands varies along a latitudinal cline: Implications for management. Austral Ecology.

**Lowe K**, Castley G, & Hero J-M (2015) Resilience to climate change: complex relationships between wetland hydroperiod, larval amphibians, and aquatic predators in temporary wetlands. Marine and Freshwater Research. 66(10) 886-899.

**Lowe K**, Castley G, & Hero J-M (2013) Acid frogs can stand the heat: amphibian resilience to wildfire in coastal wetlands of eastern Australia. International Journal of Wildland Fire 22(7), 947-958.

**Lowe K** & Hero J-M (2012) Sexual dimorphism and colour polymorphism in the wallum sedge frog (Litoria olongburensis). Herpetological Review 43(2), 236-240.

**Lowe K** & Hero J-M (2011) Amplexus mismatch (Litoria cooloolensis). Herpetological Review 42(4), 585-586.

Shoo LP, Olson DH, McMenamin SK, Murray KA, Van Sluys M, Donnelly MA, Stratford D, Terhivuo J, Merino-Viteri A, Herbert SM, Bishop PJ, Corn PS, Dovey L, Griffiths RA, **Lowe K**, Mahony M, McCallum H, Shuker JD, Simpkins C, Skerratt LF, Williams SE & Hero J-M. (2011) Engineering a future for amphibians under climate change. Journal of Applied Ecology 48(2), 487-492.

**Lowe K**, FitzGibbon S, Seebacher F & Wilson RS. (2010) Physiological and behavioural responses to seasonal changes in environmental temperature in the Australian spiny crayfish Euastacus sulcatus. Journal of Comparative Physiology B. Vol 180 (5) pp 653-660.

Book chapters:

Hero J-M, Roberts JD, Hoskin CJ, **Lowe K**, Narayan EJ & Bishop PJ. (2014) Austral Amphibians – Gondwanan relicts in peril. In Austral Ark (edited by A. Stow, Maclean and Howell), Cambridge University Press. Link: http://www.bookdepository.com/Austral-Ark/9781107033542

Baum S, **Lowe K**, Horton S. (2009) "Urban Local Governments and Human Health in a Climate of Change" Section 3, Part 8 In: Green CITYnomics: The Urban War against Climate Change, Greenleaf Publishing, UK.

Invited chapters:

**Lowe K**, Horton S, Baum S. "Local Government and Health in a Climate of Change." National Economics: State of the Regions Report 2007. Australian Local Governments Association.

Technical reports:

Environmental Protection and Biodiversity Conservation Act, Referral guidelines for the vulnerable wallum sedge frog, Litoria olongburensis. Web link: https://www.environment.gov.au/resource/draft-referral-guidelines-wallum-sedge-frog-litoria-olongburensis

**Lowe K**, Horton S, Baum S, Gleeson B. (2007) "Climate Change, Health Impacts and Urban Adaptability: a Case Study of the Gold Coast Region" Australian Greenhouse Office, Canberra.

Conference presentations:

**Lowe K**, Castley G., & Hero J-M. "Acid frogs can stand the heat". South East Queensland Fire and Biodiversity Consortium, North Stradbroke Island, March 2015.

**Lowe K**, Hero J-M & Castley GJ. "The frogs are greener on the other side of the fire" Australian Society of Herpetologists Conference 2014, Greenhills Conference Centre, ACT.

**Lowe K**, Hero J-M & Castley GJ. “Breeding phenology of the wallum sedge frog (Litoria olongburensis): adaptability to unpredictable hydrology in coastal wallum wetlands” Australian Society of Herpetologists Conference 2013, Point Wolstoncroft, NSW.

**Lowe K**, Hero J-M & Castley GJ. “Acid frogs can stand the heat: morphological and ecological responses to fire”. World Congress of Herpetology in Vancouver, Canada 8-14 August 2012.

**Lowe K**, Hero J-M & Castley GJ. “The frogs are greener on the other side: sexual dimorphism and colour polymorphism in the wallum sedge frog (Litoria olongburensis)” Environmental Futures Centre Retreat 2011, Mt Tamborine, Qld. (Awarded best student presentation).

**Lowe K**, Hero J-M & Castley GJ. “Breeding phenology and environmental correlates of activity of the Wallum sedge frog (Litoria olongburensis) in coastal Wallum wetlands of eastern Australia” Australian Society of Herpetologists Conference 2010, Barmera, SA.

## Qualifications

Masters of Natural Resources, University of New England, 2015

University of Queensland Masters Qualifier, 1993

Bachelor of Science, Australian National University, 1999

## Professional memberships & associations

Ecological Society of Australia

Australian Forest History Society Inc

Karangi Landcare

# Nigel Cotsell

## Coffs Harbour Manager / Senior Ecologist

Nigel has a wealth of experience and knowledge from a diverse range of environmental portfolios across the three tiers of Australian government, the private sector and overseas including:

- State - Office of Environment and Heritage, Queensland Department of Environment and Heritage and South Australian Department of Environment and Heritage;
- Local - Coffs Harbour City Council
- Federal - Department of Primary Industries and Energy and Department of Environment
- International - New Zealand Department of Conservation.

For the last 10 years Nigel has been operating as a senior manager across a range of Natural Resource Management portfolios with a demonstrated track record of providing direction and achieving results through multidisciplinary teams. Nigel has worked across a range of policy, strategic planning and environmental legislation to deliver, with partners, a range of targeted threatened species and ecosystem management priorities that includes key elements of the NSW government's Saving our Species program.

Nigel's career has involved reporting and communicating project results to government, private sector, investors, stakeholders and the community. Brokering multi-stakeholder partnerships that align with organisational priorities to achieve threatened species outcomes has been a focus of his career.

Nigel has experience in:

- Ecological assessment
- Biodiversity strategic planning
- High value arboreal habitat (HVAH)
- Old-growth forest
- Threatened species
- Landscape corridors and bio-links
- Vegetation assessment and mapping
- Climate change landscape resilience
- SEPP44 and Koala Plans of Management

# Project experience

| Date | Project | Client | Project Position | Role |
|---|---|---|---|---|
| **Natural Resources** | | | | |
| 2008 | Weed Hygiene Action Plan | Cradle Coast NRM<br>Tasmania | Director<br>Great Eastern Ecology | Developed a weed hygiene plan for the Cradle Coast NRM area of Tasmania |
| **Government** | | | | |
| 2016 – 2017 | Saving our Species program & landscape conservation planning | Office of Environment and Heritage | Senior Team Leader | Managed and coordinated a team of eleven professional staff to deliver regional conservation programs across North East NSW.<br>Delivered the NSW Government Saving our Species program priorities in the North East region. Worked with partners to leverage commitment such as financial investment, in-kind contribution, skills and expertise |
| 2008 - 2016 | Biodiversity assessment and management | Coffs Harbour City Council | Team Leader – Biodiversity | Adoption of key environmental strategies including a Biodiversity Management Plan and development of a fine-scale vegetation map for the entire LGA.<br>Integration of a range of environmental considerations into a new Standard Local Environmental Plan for the LGA.<br>Built a highly motivated and professional biodiversity team within council |
| 1999 – 2002 | Species re-introductions<br>Strategic conservation planning | Department of Environment and Heritage (Port Lincoln, South Australia) | Regional Ecologist | Led a multi-disciplinary team and accountable for the coordination and delivery of region-wide high quality conservation programs.<br>Project coordinator for several species re-introduction programs including the Brush-tailed Bettong, Bush Stone Curlew, SA Tammar Wallaby and Bilby.<br>Strategic planning for a range of future conservation initiatives proposed for the Eyre Peninsula. |
| 1996 – 1999 | Wilderness identification | Environmental Protection & Regulation Division – Department of Environment & Conservation | North East Wilderness Coordinator | Preparation of a wilderness report describing the assessment, identification and options for declaration of wilderness in north-east NSW.<br>Assessed 24 areas covering 475,000 hectares with several now declared wilderness under the Wilderness Act. |
| | Ecosystem and threatened species recovery | NSW National Parks and Wildlife Service<br>Northern Region | Threatened Species Officer | Primarily responsible for Recovery plan coordination and preparation. Other tasks included EIS and SIS reviews. During the course of this position I worked extensively with the provisions of the Threatened Species Conservation Act 1995 (TSC Act), Wilderness Act 1987 and National Parks and Wildlife Act 1974. |
| **Other relevant consulting experience** | | | | |
| 2005 - 2007 | Flora and fauna assessments | Councils, developers, re-zonings, private entities | Director | Preparation of numerous ecological reports encompassing SEPP44, Koala Plans of Management, community vegetation mapping, habitat and threatened species assessment. Identification of high value environments and communities. |

## Licences

- Advanced 4WD Course (NSW, SA)
- Advanced Negotiation Skills
- Defensive driving (NSW, SA)
- CFS Training (NSW, SA, QLD)
- Boatmasters
- VHF Radio Operator
- St Johns First Aid
- Law enforcement (NSW, SA)
- Guns in the workplace (SA)
- NSW Driver Licence (9961BH)
- Risk Management

## Publications and presentations

Cotsell N., & Vernes K., (2016) Camera traps in the canopy: surveying wildlife at tree hollow entrances. *Pacific Conservation Biology* **22**, 48-60.

Cotsell N., Fisher M., Scotts D., Cameron M., (2016) Identifying High Value Arboreal Habitat in forested areas using high-resolution digital imagery. *Pacific Conservation Biology* **22**, 367-376.

Cotsell, N. (2015). The importance of old eucalypt trees and the wildlife that depend on them. Masters of Natural Resources thesis. University of New England.

Scotts, D., Cotsell., N (2014) Landscape Corridors of the Coffs Harbour Local Government Area. Coffs Harbour City Council, Coffs Harbour, New South Wales, Australia. Unpublished report.

Fisher, M., Cotsell, N., Scotts, D., Cameron, M. (2014). High Value Arboreal Habitats in the Coffs Harbour Local Government Area. A joint project between the OEH and CHCC, Coffs Harbour, NSW, Australia.

Coffs Harbour City Council (2012) Development of a Fine-scale Vegetation Map for the Coffs Harbour Local Government Area, Volume 1: Project Report.

Cotsell, N. (2012). Coffs Harbour Biodiversity Action Strategy 2012 – 2030. Coffs Harbour City Council.

NSW National Parks and Wildlife Service (2001) Northern Wilderness Assessment Report.

Cotsell, N. (2009). Methods to control feral cats in Australia and New Zealand (*felis catus*). A critique. Unpublished Department of Conservation (2004) South Island Beech Forest Action Plan. Department of Conservation, New Zealand.

Cradle Coast Natural Resource Management Committee (2008) Weed Hygiene Action Plan – preventing weed spread in the Cradle Coast Region.

Cotsell, N. (2002) Biodiversity Plan for Eyre Peninsula SA 2002 – 2010. South Australian Department of Environment and Heritage. NSW National Parks and Wildlife Service (2001) Northern Wilderness Assessment Report.

Elks, G., Brown, D. & Cotsell (1999) *Eleocharis tetraquetra* Nees. Recovery Plan. NSW National Parks and Wildlife Service.

Cotsell, N., & Jackson, S., (1996) Sweet success for the mahogany glider. *Nature Australia*.

Queensland Government (1995) Mahogany Glider Conservation Plan. Queensland Department of Environment and Heritage.

# Rebecca Diete

## CQ Wildlife Services Team Leader

Rebecca Diete joined the Rockhampton team in 2020. She is a wildlife ecologist with a background in threatened and invasive species research, wildlife monitoring and conservation, and natural resource management. She has extensive experience leading fauna surveys in various remote locations; particularly in northern Australia.

Prior to joining Ecosure, Rebecca worked in the conservation sector, managing monitoring and research projects across four Queensland reserves. She has participated in land management activities such as planned burns, wildfire response, and pest management for the private sector and state government.

Rebecca has collaborated on various projects with a wide variety of stakeholders including resource industries, graziers, government agencies, Indigenous corporations, conservation NGOs, and universities. Her post-graduate research projects have required strong liaison and communication skills to improve conservation and human health outcomes on mine sites and in Indigenous communities on Australian tropical islands. She has taught several ecology and wildlife related subjects for undergraduate students at The University of Queensland.

Rebecca has experience in:

- biodiversity surveys
- population ecology
- monitoring for ecological management outcomes
- marine turtle monitoring
- Indigenous engagement
- land management planning
- fire management planning
- vertebrate pests
- weed ecology

## Qualifications

PhD (Wildlife Ecology), The University of Queensland, 2017

BAppSci (Hons), The University of Queensland, 2010

BAppSci (Wildlife Science), The University of Queensland, 2009

### Professional memberships & associations

Adjunct Fellow, The University of Queensland

Ecological Society of Australia

The Australian Mammal Society

### Areas of expertise

Terrestrial vertebrate ecology

Rodents/small mammals

Herpetology

ecosure
improving ecosystems

# Project experience

| Date | Project | Client | Project Position | Role |
|---|---|---|---|---|
| **Mining, Natural Resources & Telecommunications** | | | | |
| 2016 | Threatened species surveys | Telstra | Ecologist | Conducted preclearance surveys for threatened species and their habitat in construction areas in northern Australia |
| 2015-2016 | Threatened species surveys | Groote Eylandt Mining Company | Ecologist | Conducted preclearance surveys for threatened species and their habitat in mining and exploration lease areas |
| 2012 | Logging effects on wildlife | Cloudy Bay Sustainable Forestry Ltd | Volunteer advisor/ field assistant | Assisted and advised an honours student conducting wildlife research in logged and undisturbed tropical rainforests in Papua New Guinea |
| **Government** | | | | |
| 2018 & 2019 | Population census for the bridled nailtail wallaby | Queensland Government | Ecologist | Led small teams of volunteers to trap, handle, microchip and collect biological samples from endangered wallabies |
| 2008-2013 | Long term population studies of marine turtles in southern Queensland | Queensland Government | Volunteer field researcher | Behavioural monitoring, morphological measurements, tagging and nest conservation of three species of marine turtles on southern Queensland coasts and islands |
| 2013 | Camera trapping course for Aboriginal ranger groups | Invasive Animal CRC/ DPI | Volunteer instructor | Assisted with the coordination and implementation of a practical camera trapping course for Indigenous Protected Area Rangers in the Kimberley |
| 2011 | Caring for Country – Artesian springs recovery | Queensland Government | Field officer/ ranger | Assisted with conserving Artesian springs and their endemic fauna on national parks and grazing properties in South-West Queensland |
| 2011 | Caring for Country – Currawinya Lakes | Queensland Government | Field officer/ ranger | Designed a terrestrial vertebrate survey across different landforms of Currawinya National Park |
| **Wildlife Management and Research** | | | | |
| 2019-present | The effects of fire, landform and grazing on small vertebrates in central Queensland | The University of Queensland | Academic co-supervisor/ ecologist | On-ground and academic supervision of a PhD project investigating fauna ecology in fire-prone systems under various land uses |
| 2016-2017 | Biodiversity surveys of Cape York Nature Refuges | Northern Gulf Resource Management Group | Ecologist | Led small teams of volunteers and Aboriginal rangers to conduct fauna surveys on nature refuges and IPAs in the Cooktown region |
| 2012-2016 | Ecology and conservation of the northern hopping-mouse and sympatric vertebrates of Groote Eylandt | Groote Eylandt Mining Company | Researcher/ project manager (PhD) | Designed and executed a research project to describe the population ecology of the northern hopping-mouse. Refined monitoring methods for this and other sympatric vertebrate species. Advised on ongoing management and conservation of threatened species |
| 2016 | Masked owl and microbat surveys in remote northern Australia | Ecological Management Services | Ecologist | Conducted call playback surveys for masked owls and harp trapping for microbats in remote NT and QLD locations |
| 2016 | Remote wildlife surveys in the Kimberley | Australian Wildlife Conservancy | Volunteer research assistant | Remote (via helicopter) surveys for rare and threatened species in the Artesian Range, WA |
| 2015 | Microbat diversity surveys on Groote Eylandt | Ecological Management Services | Volunteer field researcher | Baseline surveys of microbat diversity using harp trapping and echolocation call detection |
| 2013 | Population studies of marine turtles in La Coronilla, Uruguay | Karumbe Research Station | Volunteer research assistant | Assisted with the capture, handling, monitoring, and rehabilitation of marine turtles and stranded marine mammals |

| Date | Project | Client | Project Position | Role |
|---|---|---|---|---|
| 2012 | Desert Ecology Research | University of Sydney | Volunteer field assistant | Trapping, handling and data collection of arid zone terrestrial vertebrates |
| 2011 | Eradication of exotic rodents on Mer Island | The University of Queensland/ Queensland Government | Project officer | Engaged and liaised with Torres Strait Islander community to conduct rodenticide baiting in remote Indigenous townships |
| 2010 | Ecology of exotic rodents and non-target species on Torres Strait Islands | The University of Queensland | Researcher (Honours) | Designed and executed a research project describing the baseline fauna ecology of Mer Island prior to exotic rodent eradication. Conducted experiments on baiting efficacy and non-target exclusion on Poruma and Mer |
| 2009 | Field trials for poison bait efficacy on house mice | The University of Queensland | Research assistant | Conducted field trials, including animal trapping and handling, in a controlled experiment to test bait efficacy on invasive rodents in food crop systems |

## Training

- Drive and recover a 4WD vehicle
- Drive a 4WD in difficult terrain
- Coordinate recovery of a 4WD vehicle
- Operate side by side utility vehicles
- Maintain chainsaws
- Trim and cut felled trees
- Firearms safety course category A B
- Use firearms to humanely destroy animals
- Venomous snake handling
- Firefighter minimum skills
- Control weeds
- Prepare and apply chemicals
- Transport and store chemicals

## Licences

- ACDC – Commercial Operators Licence
- Chainsaw Licence
- Chemcert Licence
- Marine Licence

## Publications and presentations

Diete, R., 2018. The northern hopping-mouse on Groote Eylandt…and beyond?. In: *The Territory Natural Resource Management Conference*, Darwin.

Diete, R., Meek, P., Dickman, C., Lisle, A. and Leung, L., 2017. Diel activity patterns of northern Australian small mammals: variation, fixity, and plasticity. *Journal of Mammalogy*, 98(3), pp. 848-857.

Diete, R., Meek, P., Dickman, C. and Leung, L., 2016. Ecology and conservation of the northern hopping-mouse (*Notomys aquilo*). *Australian Journal of Zoology*, 64, pp. 21-32.

Diete, R., Meek, P., Dixon, K., Dickman, C., and Leung, L., 2016. Best bait for your buck: bait preference for camera trapping north Australian mammals. *Australian Journal of Zoology*, 63, pp. 376-382.

Diete, R., Dixon, K., and Barden, P., 2016. Predation of pitfall-trapped rodents by the ghost bat, *Macroderma gigas*. *Australian Mammalogy*, 38, pp. 249-252.

Diete, R., Adamczyk, S., Meek, P., Dickman, C., and Leung, L., 2015. Burrowing behaviour of the delicate mouse (*Pseudomys delicatulus*) and the management implications for a threatened sympatric rodent (*Notomys aquilo*). *Australian Mammalogy*, 37, pp. 260-263

Diete, R., Meek, P., Dickman, C., and Leung, L., 2014. Burrowing behaviour of the northern hopping-mouse (*Notomys aquilo*): field observations. *Australian Mammalogy*, 36, pp. 242-246.

Diete, R., 2014. Camera traps reveal the burrowing behaviour of two sympatric rodents with implications for threatened species management. In: *14th International conference on rodent biology*, Lisbon.

Diete, R., 2011. The ecology of exotic rodents and non-target species on Torres Strait Islands. In: *15th Australasian vertebrate pest conference*, Sydney.

# Dr Natalie Toon

## Senior Environmental Scientist / SEQ Environmental Services Manager

Natalie is an environmental scientist with a speciality in marine and freshwater ecosystems. She has 15 years' experience managing and working on private enterprise, government and academic projects in both Queensland and Western Australia.

Natalie's ecological and scientific background provides her with a strong understanding of ecological systems and processes, as well as the governing environmental legislation, its application on ground, and the implication of compliance aspects for clients. She combines her project management experience with her experience in biological surveys, environmental monitoring programs and research projects, to provide valued results for clients.

Prior experience incorporates project development and implementation, along with skills in data management and statistical analysis, through to project completion and report production. Natalie works closely with clients and other team members to develop ecologically sustainable outcomes for a range of projects.

Natalie has experience working with a variety of stakeholders across government, industry and academia. She has authored a number of publications, presented at national and international conferences and is a member of ecological and environmental groups in Australia.

Natalie has experience in:

- ecological and biological surveys
- baseline data collection and reporting
- environmental project management
- environmental management plans
- ecological data management and statistics
- project planning and implementation
- stakeholder coordination and liaison
- aquatic ecology
- fisheries research.

## Qualifications

Doctorate of Philosophy, Murdoch University, 2013

Bachelor of Science (Honours), University of Queensland, 2004

Bachelor of Science, University of Queensland, 2001

AUSRIVAS Accreditation, University of Canberra, 2015

## Professional memberships & associations

Australian Marine Sciences Association – Qld Secretary

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improving ecosystems

# Project experience

| Date | Project | Client | Project Position | Role |
|---|---|---|---|---|
| **Government and academia** | | | | |
| 2019 | Saltwater Creek Bridge Upgrade - Ecological Assessments | Department of Transport and Main Roads | Project Manager and Ecologist | Delivery of targeted baseline assessments for conservation significant fauna and flora, including terrestrial and aquatic surveys. Significant residual impact assessments and construction environmental management advice. Leading aquatic surveys for threatened turtle, fish and invertebrate species. |
| 2019 | Threatened Species Action Plan | Fraser Coast Regional Council | Ecologist | Delivery of a Threatened Species Action Plan for the Fraser Coast Regional Council area. Identifying species of local significance for the region. |
| 2019 | Wyaralong Dam Vegetation Management and Foreshore Protection Plan | Seqwater | Ecologist | Delivery of a Vegetation Management and Foreshore Protection Plan for a portion of the Wyaralong Dam. |
| 2018 | Ecological Assessment | Queensland Rail | Project Manager / Environment Scientist | Delivery of an ecological assessment for a proposed development site for Queensland Rail. Including addressing the flora and fauna ecological constraints, including non-juvenile koala habitat trees and conservation significant species. |
| 2018 | Waterbody Remediation Assessment | Brisbane City Council | Project Manager / Environment Scientist | Delivery of an options assessment for the remediation of a waterbody in Brisbane City Council that experiences frequent algal blooms |
| 2018 | Turtle Nesting Assessment | Brisbane City Council | Project Manager / Environment Scientist | Delivery of an options assessment for the nesting habitat of freshwater turtles at three lagoons within Brisbane City Council |
| 2018 | Levee bank and culvert remediation | Moreton Bay Regional Council | Project Manager / Environment Scientist | Provided environmental waterways and fish passage advice for the remediation of a damaged pipe culvert. Facilitated the delivery of a habitat assessment and protected plant survey for the operational works. |
| 2018 | Contaminated Land Due Diligence Assessment | Commercial in Confidence | Project Manager | Facilitated the delivery of a contaminated land due diligence on a parcel of land for a regional council |
| 2018 | Luscombe Weir Assessment | Gold Coast City Council | Project Manager / Aquatic Scientist | Aquatic Scientist undertaking macroinvertebrate, electrofishing and water quality surveys on the Albert River. Delivery of the report also addressing platypus and tusked frog surveys |
| 2018 | Waste Management Facility Receiving Environment Monitoring Program | Fraser Coast Regional Council | Project Manager / Environment Scientist | Delivery of a Receiving Environment Monitoring Program for Council's ten licenced waste management facilities. Including surface water and groundwater receiving environments |
| 2018 | Ecological Assessment | Gold Coast City Council | Project Manager | Assisted in the delivery of an ecological assessment for a proposed development site for Gold Coast City Council. Including addressing the flora and fauna ecological constraints |
| 2017 | Magpie Behavioural Assessment | Brisbane City Council | Environment Scientist | Project manager for the delivery of a magpie behavioural assessment and report findings to Brisbane City Council, including client and stakeholder liaison |

| Date | Project | Client | Project Position | Role |
|---|---|---|---|---|
| 2014-2015 | Commonwealth Games Infrastructure – Velodrome, shooting range, Chandler. Koala Offset Delivery Plan | Department of State Development, Infrastructure and Planning | Senior Environment Consultant | Liaison with state government levels, writing and delivery of a proponent driven Koala Offset Delivery Plan, according to the relevant state legislation. |
| 2014 | Construction Environmental Management Plan in Redland City Council | Department of Housing and Public Works | Environment Consultant | Provide environmental advice and assist in the delivery of a Construction Environmental Management Plan |
| 2013 | Yalgorup National Park National Heritage Listing | City of Mandurah, Western Australia | Project Manager | Undertake a detailed scientific review on the ecological systems and processes of Yalgorup lakes and prepare the heritage listing advice statement and supporting documentation. |
| 2005-2006 | Fisheries Long Term Monitoring Program | Queensland Department of Primary Industries and Fisheries | Fisheries Biologist | Review of syngnathids in Queensland Trawl Fishery in accordance with Commonwealth legislation, fish and invertebrate identification, analysis and report on data and ocean beach fisheries annual monitoring, reporting and development of sampling protocols |
| 2004 | Freshwater Ecosystem Health Monitoring Program | Queensland Department of Natural Resources and Mines | Scientist | Undertake baseline monitoring studies including benthic metabolism assessment, water quality, stream habitat characterisation and macroinvertebrate assessments for the Ecosystem Health Monitoring Program |
| 2003-2004 | Behaviour of Coral Trout on the Great Barrier Reef | University of Queensland | Research (Honours) | Undertake a study into the behaviour of coral trout between open and closed fishing zones in the Capricorn Bunker Group of the Great Barrier Reef. |
| **Aquatic Ecology** | | | | |
| 2020 | Tilapia Control Program | City of Gold Coast | Project Manager and Ecologist | Delivery of a boat based electrofishing control program of one lakes within City of Gold Coast for Mozambique tilapia (*Oreochromis mossambicus*). |
| 2020 | Sideling Creek Aquatic Fauna Management | Seqwater | Project Manager and Ecologist | Downstream fishway and spillway assessment to monitor the aquatic fauna. |
| 2020 | Logan Waterway Assessment | Gassman Development Perspectives | Project Manager and Ecologist | Fish passage assessment and waterway barrier works approvals, addressing State Codes. |
| 2019 | Aquaculture Farm Approvals | Private Landholder | Aquatic Ecologist | Fish passage assessment and waterway barrier works approvals |
| 2019 | Westbank Polishing Lagoon remediation | CC P & C and Seqwater | Aquatic Ecologist | Aquatic baseline assessments, dewatering, turtle and fish salvage works |
| 2019 | Lady Annie Mine REMP | SGM Environmental | Aquatic Ecologist | Delivery of the annual REMP macroinvertebrate assessment for Lady Annie Mine. |
| 2019 | Tilapia Control Program | Brisbane City Council | Project Manager and Ecologist | Delivery of a boat based electrofishing control program of two lakes within Brisbane City Council for Mozambique tilapia (*Oreochromis mossambicus*). |
| 2019 | Black Duck Lakes Aquatic Assessment | Moreton Bay Regional Council | Project Manager and Ecologist | Baseline aquatic assessments and tilapia control of two of waterbodies within the Black Duck Lake system. Baseline assessments included macroinvertebrates, fish, turtle and water quality. |

| Date | Project | Client | Project Position | Role |
|---|---|---|---|---|
| 2019/ 2020 | Sidling Dam Spillway Fish Salvage | Fulton Hogan and Seqwater | Project Manager and Aquatic Ecologist | Dewatering advice and fish salvage for sidling dam spillway and downstream aquatic habitat. Euthanasia and appropriate disposal of biosecurity risks. Successful capture and relocation of over 3,000 individual fish and turtles. Salvage access was difficult requiring ladders and many personnel, but Ecosure was able to successfully complete works while adhering to safety procedures of both Seqwater and Fulton Hogan. |
| 2019 | Sydney Fish Market Fauna Management | Urban Growth NSW Development Corporation | Fisheries Biologist | Assessment of the fisheries operations at the current Sydney Fish Market for proposed management and mitigation measures for the design and development of the new Sydney Fish Market. |
| 2017 - 2019 | Brisbane Community Catchment Group Training - Macroinvertebrates | Brisbane City Council | Aquatic Training Facilitator | Lead a training course to teach community catchment group volunteers on macroinvertebrate sampling, picking, identification to order level and data usage and analysis. |
| 2018 | Sewage Pumping Station Aquatic Values Assessment | Private Landholder | Project Manager | Delivery of an aquatic values assessment of a private landholder's lake downstream of a newly installed sewage pumping station. |
| 2017 - 2020 | Lower Fitzroy River Turtle Surveys | GHD | Environment Scientist | Field scientist for the capture, tagging and tracking of turtle species on the Fitzroy river, including threatened turtle species, Fitzroy River turtles and white throat snapping turtles. |
| 2017 | Oyster and Sediment monitoring Gladstone Port | Queensland Alumina Limited | Aquatic/ Marine Ecologist | Field lead in the collection of oyster, sediment and water quality sampling. Data analysis and report production |
| 2017 | Instrument Landing System Construction – Gold Coast Airports | Hazell Brothers Pty Ltd | Aquatic/ Marine Ecologist | Estuarine fish salvage and water quality monitoring and reporting |
| 2017 | Caloundra to Sunshine Motorway Bruce Highway Upgrade | Fulton Hogan Seymour White Joint Venture | Aquatic Ecologist | Dewatering fish salvage and swamp crayfish assessments |
| 2017 | Callide Power Station | CS Energy | Environment Scientist | Water quality and aquatic conditions assessment. |
| 2017 | Macroinvertebrate Support Role, SEQ (Tarong region) | Ecological Service Professionals | Aquatic Ecologist | Aquatic laboratory assistance |
| 2016 | Maleny Monitoring Program, (Macroinvertebrate Identification) | Ecological Service Professionals | Aquatic Ecologist | Aquatic laboratory assistance, identification of Macroinvertebrates to family level. |
| 2016-2017 | Coastal Citizen Science | Wildlife Preservation Society Queensland | Marine Scientist | Assisted in the co-ordination of coastal citizen science projects within Moreton Bay, Brisbane River and Logan River. |
| 2012-2015 | Moreton Bay Aquaculture, Moreton Bay | Australian Sea Cucumbers | Senior Aquatic Consultant | Environmental advice, operational design advice, approvals support and preparation of supporting documentation. |
| **Mining, Energy & Natural Resources** | | | | |
| 2017 | Tidal works Gas Pipeline - Brisbane City Council LGA | APT Management Services | Environment Scientist | Finalisation of a tidal works permit application and consultancy advice |
| 2016 | Moorelands Coal Transmission Line, Central Queensland | Cuesta Coal | Environment Support | Provide environmental advice and support and assist in the reporting and preparation of prefeasibility documents. |
| 2014 | Mine Prefeasibility, Project Environmental Planning and Initial Advice Statement | Moreton Resources | Environment Consultant | Provide environmental advice and support and assist in the reporting and preparation of the Initial Advice Statement. |

| Date | Project | Client | Project Position | Role |
|---|---|---|---|---|
| **Urban Development & Infrastructure** | | | | |
| 2019 | Gold Coast Seaway | John Holland | Environment Consultant | Environmental advisor, water quality assessment and assisting in the delivery of Noise Management Plans and monitoring. |
| 2019 | Little Nerang Dam Upgrade | Jacobs Group | Project Manager / Ecologist | Delivery of an Ecological Assessment and approvals advice for a Seqwater road upgrade in the design phase. |
| 2019 | Mount Lindsay Highway Upgrade | Jacobs Group | Project Manager / Ecologist | Delivery of an Ecological Assessment and approvals advice for a DTMR road upgrade design phase works. |
| 2019 | Greenbank Pump Station | CC P & C | Environment Consultant | Assisted in the delivery of erosion and sediment control plans for the Greenbank pump station construction. |
| 2019 | Byron Bay Road Upgrade | Hazell Bros | Project Manager | Dewatering of a stream for culvert repairs on a road upgrade project in Byron Bay Council. |
| 2019 | Mountain Bike Trail development application | Jilrift | Project Manager / Ecologist | Delivery of an Ecological Assessment, fauna management assessments and waterways advice statement for the approval of a 150 km Mountain Bike Trail. |
| 2019 | Road upgrades – Gladstone | Roadtek | Coastal (CMD) approvals | Development and advisory role for coastal management district and tidal works approvals |
| 2019 | Boondall Wetlands Environmental Education Centre | A Dart & Co. | Ecologist | Provision of Fauna Management Plan, Fauna management works, botanists, marine plant ecologists and general ecological advice. |
| 2018 | Various Roads Upgrade (Logan City Council, Scenic Rim Regional Council and Gold Coast City Council) | Hazell Bros Group | Project Manager / Environment Advisor | Environmental Management Plans, environmental advisor, aquatic consultant, environmental compliance monitoring and reporting, surface water monitoring, approvals and permits |
| 2018 | Trunk Sewer Main Upgrade – Pine Rivers | Christopher Contracting | Project Manager / Environment Advisor | Environmental Management Plans, aquatic/marine consultant, environmental compliance monitoring and reporting, surface water monitoring, approvals and permits |
| 2018 | Fauna Management Plan | Gassman Development Perspectives | Project Manager / Environment Consultant | Delivery of a Fauna Management Plan for two stages of a commercial subdivision in Gold Coast City Council. Providing monitoring for locally significant species and assisting with the management of these species ongoing for the development. |
| 2017 | Instrument Landing System and Glidepath Extension Construction – Gold Coast Airports | Hazell Bros Group | Project Manager, Environment Advisor | Environmental Management Plans, aquatic/marine consultant, Environmental Compliance monitoring and reporting, surface water monitoring and groundwater monitoring |
| 2017 | Ecological Assessment for a 1 into 3 lot subdivision – Loganholme | Capital Wealth Properties | Environment Scientist | Project manager for the ecological surveys, client liaison, provision of environmental advice and preparation and delivery of the ecological assessment report |
| 2017 | Stockleigh Urban Development - Vegetation Management Plan, Rehabilitation Management Plan and Fauna Management Plan | Wolter Consulting Group | Senior Environment Consultant | Managed flora and fauna surveys, provide environmental advice and prepare and deliver vegetation, rehabilitation and fauna management plans. |
| 2017 | Calamvale Urban Development | Wolter Consulting Group | Senior Environment Consultant | Managed flora and fauna surveys, provide environmental advice and prepare and deliver Ecological Assessment Report according to the Brisbane City Council City Plan 2014. |
| 2017 | Logan Reserve Urban Development | Wolter Consulting Group | Senior Environment Consultant | Managed flora and fauna surveys, EVNT flora targeted surveys, provide environmental advice and prepare and deliver Ecological Assessment Report according to the Logan City Council Planning Scheme 2015. |

| Date | Project | Client | Project Position | Role |
|---|---|---|---|---|
| 2016-2017 | Koala Habitat Assessment, Redlands City Council | Vanstone Rise Residents | Project Manager | Managed flora and fauna surveys, provide environmental advice and prepare and deliver a Koala Habitat Assessment Report. |
| 2016 | Moreton Bay Regional Council Urban Development Vegetation Management Plan | North Group Surveys | Senior Environment Consultant | Managed flora and fauna surveys, provide environmental advice and prepare and deliver Vegetation Management Plan. |
| 2014 | South Brisbane Prefeasibility Site History Assessment | Pindan | Environment Consultant | Prefeasibility due diligence including current and historical site uses to report on the potential site contamination. |

## Training

- AUSRIVAS accreditation, University of Canberra
- 4WD Training Course, Murdoch University
- Multivariate (Primer) Statistics short course
- Univariate Statistics short course, University of Western Australia
- Genstat short course, QDPIF
- Microsoft Excel Programming for Biosciences, Murdoch University

## Licences

- Queensland Driver Licence (Marine, Car)
- Open Water Diving Licence (PADI)

## Publications and presentations

Toon, N.M. (2012) Behaviour of the western rock lobster (*Panulirus cygnus*): the influence of temperature, moonlight intensity and commercial fishing apparatus. PhD Thesis, Murdoch University, Perth, Western Australia. 237p.

Toon, N. & Loneragan, N. (2011). Behaviour of western rock lobster to commercial traps. Presentation at Australian Marine Science Association Conference, Perth.

Toon, N. & Loneragan, N. (2010) Trap behaviour of the western rock lobster. Presentation at Joint Indo-Pacific Fish Conference/Australian Society for Fish Biology Conference, Perth.

Dodt, N. and Roy, D. (2006) Distribution of *Solegnathus* species and their associated community assemblage in south-east Queensland trawl grounds. Presentation at Australian Society for Fish Biology Conference, Hobart.

Dodt, N. (2006) Fisheries Long Term Monitoring Program - Syngnathids in the East Coast Trawl Fishery: a review and trawl survey. Department of Primary Industries and Fisheries QI05091, Brisbane, Australia.

Dodt, N., Roy, D., Smallwood, D. & O'Sullivan, S. (2007) Fisheries Long Term Monitoring Program: Summary of Mullet Survey Results 1999-2004. Department of Primary Industries and Fisheries, Queensland, Brisbane, Australia.

Dodt, N., O'Sullivan, S., McGilvray, J., Jebreen, E., Smallwood, D. & Breddin, I. (2006) Fisheries Long Term Monitoring Program Summary of Tailor Survey Results 1999-2004. Department of Primary Industries and Fisheries, Brisbane, Australia.

Dodt, N. & McPhee, D. (2004) *Plectropomus* Behavioural Reponses to Human Presence in Open and Closed Fishing Zones, Southern Great Barrier Reef. Presentation at Australian Society for Fish Biology Conference 2004, Adelaide.

Dodt, N. (2004) *Plectropomus* Behavioural Reponses to Human Presence in Open and Closed Fishing Zones, Southern Great Barrier Reef, Australia. Honours Thesis, University of Queensland, Brisbane. 78 p.

# Heather Richards

## Business Process Manager / Senior Environmental Scientist

Heather is a Senior Environmental Scientist with over 15 years of experience in both the public and private sector. Her project, management, systems and processes skills provide a multitude of experience to oversee the development, refinement and implementation of Ecosure and Avisure's Business Processes.

Heather has experience in all stages of system development, from initial design, implementation, documentation, change management, training and auditing. Heather has successfully managed Ecosure and Avisure's certification against ISO 9001, ISO 14001 and AS/NZ 4801 since 2017.

Having previously managed Ecosure's Central Queensland Team, Heather is well positioned to understand how business systems impact effective and efficient field operations, and therefore project delivery and client satisfaction, and visa-versa.

Heather's experience also includes guiding the Central Queensland Team through a significant growth period, including the establishment of a North Queensland base. Heather's organisational skills will assist each business as they continue to develop their client base and service offerings.

Heather has experience in:

- Project management
- Environmental incident investigations
- Stakeholder and client liaison/consultation
- Monitoring and compliance against ISO 9001 (Quality), ISO 14001 (Environmental Management) and AS/NZ 4801 (Occupational Safety).

### Qualifications

Masters in Environmental Management (Sustainable Development), University of Queensland, 2012

Bachelor of Marine Studies, in Coastal Management, University of Queensland, 2005

### Training

First Aid

CPR

# Jen Ford

## Principal Restoration Ecologist

Jen has worked full-time in the ecological restoration industry for more than 24 years in South East Queensland and northern NSW. As a recognised industry leader and passionate advocate, Jen's skills have seen her as thought leader and catalyst for developing the restoration industry in SEQ during the last 14 years. Jen has demonstrated a strong track record of strategic leadership and contribution at senior levels in Gold Coast City Council and in industry peak bodies such as the Australian Association of Bush Regenerators, the Weed Society of QLD and the Society of Ecological Restoration. Jen has facilitated a large variety of project teams and stakeholders as well as working as a trainer and educator on restoration theory and practice. Her work with diverse communities, local councils, state agencies, federal government, traditional owners, committees, developers, peak bodies, community groups, landholders and the local restoration industry to develop and implement ecological restoration and environmental education programs has proven Jen as an effective negotiator and facilitator.

Jen has experience in:

- On-ground ecological restoration across a wide range of ecosystem types and degradation levels
- Site assessment and restoration planning including large scale restoration >1000 hectares
- Weed management in a range of situations, ecosystems and public spaces
- Strategic leadership
- Stakeholder management and building partnerships with all levels of government, industry and communities
- Negotiation, liaison, influence and advocacy
- Leading cross-disciplinary teams
- Training design and delivery to a diverse range of stakeholders including accredited training
- Project management and coordination
- Budget management and strategy

### Qualifications

International Ecological Restoration Certification

Certificate IV – Bushland Regeneration, North Coast Institute of TAFE

Certificate IV – Workplace Assessment and Training, North Coast Institute of TAFE

### Professional memberships & associations

Board Member for the Society of Ecological Restoration Australasia

Australian Association of Bush Regenerators (AABR) – Member of Executive Committee for Northern NSW and Queensland branch since 2004

AABR Assessor for Northern NSW and South East Queensland

Weeds Society of Queensland – South East Queensland representative on Executive Committee 2007-2013

Member of Society of Ecological Restoration International

### Areas of expertise

Restoration Planning at all scales – landscape, small and large sites

Project Management across short, medium and long term projects

Development of teams

Coordination of teams, budgets and projects

Leadership

Community consultation

Training including design and delivery, theory and practice

# Recent project experience

| Date | Project | Client | Project Position | Role |
|---|---|---|---|---|
| 2013-20 | Restoration Planning | Environment, Heritage and Protection (EHP)<br>City of Gold Coast (CoGC)<br>Lockyer Valley Regional Council (LVRC)<br>Brisbane City Council (BCC)<br>Seqwater<br>Gainsdale Group<br>Moreton Bay Regional Council (MBRC)<br>Redlands City Council (RCC)<br>Department of Agriculture, Fisheries and Forestry (DAFF) | Main author and team leader | Design and development of ecological restorations plans. The large plan for EHP covers all assisted regeneration, planting and maintenance requirements for 205 hectares.<br>Three restoration plans for BCC and LVRC cover the assisted regeneration and planting requirements and maintenance for all sites for up to 5 years.<br>Development of a 10 year restoration plan for a 28 ha site at Balaam Hills to ensure Council achieve offset requirements.<br>Development of an ecological restoration plan to guide the recovery of a 35 ha site to remnant status. The site requires assisted regeneration, revegetation, maintenance, fencing, fire management and monitoring as part of the offset.<br>A plan for a 4,800 ha property in Grandchester is guiding the recovery of large tracts of land including extensive riparian areas. The plan fully integrates weed control, assisted regeneration and large-scale revegetation and balances this with agricultural requirements, fire management and threatened species management including the relocation of 5 threatened fauna species.<br>Developed a restoration plan for a complex site at Harold Brown Park (MBRC). The site contains numerous regional ecosystems and degradation levels. All recommended restoration activities are balanced with high visitation rates from community.<br>Developed an Integrated Weed Management Plan for Coochiemudlo Island (RCC). Development of the plan involved numerous stakeholder meetings with community, interviews, surveys, public meetings and site assessment, mapping and planning.<br>Developed ten separate restoration action plans to guide the recovery of many sites along the Calliope River near Gladstone. |
| 2013-20 | Project Management / Coordination | Various including multiple Councils and local government departments, State government departments in Qld and NSW (e.g. Queensland Parks and Wildlife Service, Seqwater), Commonwealth (Defence sites), NRM bodies, community groups and private landholders | Project manager | Coordination of 40 people and approx. 0+ teams, equipment, job requirements, planning and tools for up to 110 separate on ground projects and approx. 20 planning and monitoring projects for the 2019/20 financial year alone. Coordination includes client liaison, budget management, rostering, training, safety and team management.<br>This financial year we are currently working on more than 100 large and high conservation value sites. |
| 2013-20 | Team Management and Team Building / Quality Assurance | Various | Team Leader | Responsible for the development, hiring and training of a growing team (currently 40 people) so current best practice ecological restoration is delivered across a wide range of areas, ecological systems and sites. Also responsible for developing and up skilling the Central Queensland and Coffs Harbour teams. |

## Licences

- International Practitioner Certification, Society of Ecological Restoration
- Australian Association of Bush Regenerators Accreditation
- Senior First Aid Certificate
- ACDC license – for safe application of chemicals
- Four wheel driving and recovery
- Blue Card – positive notice for child-related employment

## Publications and presentations

September 2019 - Society of Ecological Restoration (SER) World Conference in Cape Town, South Africa. Jen delivered a presentation on Scaling Up Ecological Restoration detailing the practical challenges and solutions. She demonstrated recent successes via two large scale projects she and the team have been working on.

September 2018 – Society of Ecological Restoration Australasia (SERA). Jen delivered two separate presentations including one on Scaling up Restoration and another on the propagation and translocation of threatened plant species in Numinbah Valley. Jen also co-led a workshop on applying the Recovery Wheel, a monitoring tool recommended in the National Standards for the Practice of Ecological Restoration and led one of the five field trips on offer to the 350+ conference participants.

August 2017 – Coastal Restoration Symposium in Townsville. Delivered the keynote address on the National Standards for the Practice of Ecological Restoration in Australia and how these can be used in all coastal restoration projects.

Jen was on the working group representing the Australian Association of Bush Regenerators for the development of the National Standards for the Practice of Ecological Restoration in Australia (2013 – 17). These standards have now been adopted by the international Society of Ecological Restoration (SER).

November 2016 – Society of Ecological Restoration Australasia (SERA) conference in Hamilton, New Zealand. Delivered a paper on the restoration of Lower Beechmont Conservation Area, a 680 ha site on the Gold Coast

November 2014 – Society of Ecological Restoration Australasia (SERA) conference in New Caledonia. Presented a paper on the development of the SEQ Ecological Restoration Framework.

Jen has Co-facilitated development of, and member of working group for, South East Queensland (SEQ) Ecological Restoration Framework. This consists of a code of practice, set of guidelines and a comprehensive how-to manual (2012)

Co-author and member of working group for Weeds of Southern Queensland (3rd edition), produced by Weeds Society of Queensland (2011)

November 2012 – Society of Ecological Restoration Australasia (SERA) – Delivered a

conference paper on ‘Development and implementation of the SEQ Ecological Restoration Framework’, Perth. Also invited to participate in a symposium to develop restoration standards for Australasia.

November 2011 – Presented to Regional Implementation Group for Environment across SEQ (including DERM, all councils in SEQ, utilities such as Energex, and representatives from farming and mining) on SEQ Ecological Restoration Framework and opportunities for implementation and different models for restoration for better ecological and economic outcomes

August 2011 – Society of Ecological Restoration International (SERI) World Conference – Delivered conference paper on ‘Increasing capacity of restoration industry in SEQ’ in Merida, Mexico

August 2009 – Society of Ecological Restoration International (SERI) World Conference – Delivered conference paper on ‘Achieving Restoration in a World of Competing Priorities’ in Perth

2009 – Presented on new models for more economically sustainable restoration at Parks Forum, a peak body representing parks across Australia and New Zealand.

June 2007 – 9th Queensland Weeds Symposium – Delivered conference paper on ‘An Integrated and Systematic Approach to Weed Control’ at Gold Coast

From 2006 to 2012, approximately 50 presentations to senior leaders in Gold Coast City Council, councils in South East Queensland, SEQ Catchments and industry forums such as the Parks Forum.

2002 – Australia and Brazil Partnership Project – Delivered presentation in Brazil on restoration of sub-tropical rainforest in northern New South Wales.

# Cameron Radford

## Senior Ecologist and Sydney Regional Manager

Cam is a highly qualified Wildlife Biologist and Ecological professional with over 12 years' experience in ecological consultancy and wildlife conservation research. Cam specialises in human-wildlife conflict resolution, wildlife research and analysis, wildlife tracking, and threatened species and communities surveys, assessment and management. Cam is responsible for delivering high-quality ecological services whilst managing the growing Sydney regional team.

Cam's ecological and scientific experience across private, NGO, government and academic sectors throughout Australia and globally has enabled him to develop a diverse ecological skill set to apply to a range of projects including biodiversity impact assessments, threatened species targeted surveys and monitoring, species reintroductions, wild canid taxonomy research, threatened ecological community recovery using fire, threatened species threat abatement, and species reintroduction and management plans. Cam has recently returned from Botswana where he undertook PhD research in predator-livestock conflict, working within local communities to develop novel and high-tech conflict solutions and understand livestock resource use and habitat selection in a landscape of fear.

Cam has presented at both national and international conferences on topics ranging from a native bush rat reintroduction, edge affects and road crossings for wildlife, livestock resource selection and a novel tool for preventing large predator attacks on livestock.

Cam has a passion for the natural environment and assisting people with finding solutions for coexistence with nature.

Cam has experience in:

- Biodiversity Impact Assessment
- Ecological reporting
- Targeted threatened species surveys and management
- Ecological community surveys
- Human-wildlife conflict resolution
- Wildlife research including project design, data collection/management and statistical analysis
- Wildlife monitoring and tracking
- Wildlife surveys
- Stakeholder engagement and liaison
- Project planning and management
- Environmental education
- GIS mapping

## Qualifications

Doctorate of Philosophy, University of NSW, current.

Masters of Wildlife Health and Population Management, University of Sydney, 2010.

Bachelor of Science (Biology and Ecology), University of Sydney, 2009.

Bachelor of Science (Exercise Science), University of Wollongong, 2004.

## Professional memberships & associations

International Union for Conservation Biology

Australian Wildlife Management Society

Southern African Wildlife Management Society

Institute

ecosure
improving ecosystems

# Project experience

| Date | Project | Client | Project Position | Role |
|---|---|---|---|---|
| **Mining, Energy & Natural Resources** | | | | |
| 2013 | Biodiversity Assessment, Arrow , Surat Basin to Gladstone | Arrow Energy | Lead Flora Ecologist | Lead flora surveys to ground truth vegetation communities and map threatened species, analysis and report on data; and assess potential route changes to mitigate ecological impacts. |
| 2014 - 2017 | Biodiversity Assessment, Jemalong Hybrid Solar Park | Vast Solar | Project Manager, Lead Ecologist | Designed and led targeted bird and TS surveys, prepared report. |
| 2016 | Biodiversity Assessment, Parkes Solar Farm | Neoen | Project Manager, Lead Ecologist | Designed and led all biodiversity surveys including threatened species and TECs, prepared report. |
| 2016 | Biodiversity Assessment, White Rock Solar Farm | Goldwind | Project Manager, Lead Ecologist | Designed and led all biodiversity surveys including threatened species and TECs, prepared report. |
| 2013 | Biodiversity Assessment surveys, Gullen Range Wind Farm | CATCON and CPP | Fauna Ecologist | Led fauna surveys to identify threatened fauna and habitat occurring on site and created vegetation and fauna maps. |
| 2013 | Biodiversity Assessment Rye Park Wind Farm | Epuron | Fauna Ecologist | Identification and mapping of hollow-bearing trees, searches and mapping for Golden Sun Moth. |
| **Roads and Infrastructure** | | | | |
| 2015 - 2018 | Nest Box Implementation Plan, Foxground and Berry Bypass | Fulton Hogan | Project Manager, Lead Ecologist | Designed, monitored and reported on nest box plan for targeted threatened species. |
| 2015 - 2018 | Fauna and aquatic monitoring, Foxground and Berry Bypass | Fulton Hogan | Lead Ecologist | Biannual fauna monitoring surveys and quarterly aquatic surveys including platypus, fish and invertebrates. Reporting. |
| 2015 - 2018 | Onsite Ecological Services, Foxground and Berry Bypass | Fulton Hogan | Project Manager, Lead Ecologist | Carried out hollow-bearing tree surveys, fauna rescue and relocation, fauna crossing installation, weed surveys, ad-hoc environmental assessments and advice. |
| 2014 - 2017 | Biodiversity Assessment, Albion Park Rail Bypass | Roads and Maritime | Lead Ecologist / Fauna Ecologist | Biodiversity surveys, TS surveys, vegetation surveys (BAM), Impact Assessment reporting |
| 2015 - 2016 | Onsite Ecological Services, WestConnex | Fulton Hogan | Project Manager, Lead Ecologist | Carried out hollow-bearing tree surveys, fauna rescue and relocation, weed surveys, ad-hoc environmental assessments and advice. |
| 2013 - 2014 | Biodiversity Assessment, Trewilga Road Realignment | Roads and Traffic Authority | Fauna Ecologist | Led fauna surveys, assisted in report preparation. |
| **Airports** | | | | |
| 2020 - present | Bird Monitoring Surveys, Sydney Airport | Sydney Airport | Senior Ecologist | |
| **Government** | | | | |
| 2016 | Riverlands Golf Course Residential Proposal | City of Canterbury-Bankstown Council | Project Manager, Lead Ecologist | Assessed impacts of proposed residential development on old growth trees. Designed nest-box management plan and fauna corridor protection. |
| | Ropes Creek | | | |
| | Catai Creek | | | |

## Revision History

| Revision No. | Revision date | Details | Prepared by | Reviewed by | Approved by |
|---|---|---|---|---|---|
| 00 | 10/08/2020 | Pest Animal Monitoring Program Draft | Ellie Kirke, Graduate Wildlife Biologist | Jess Bracks, Principal Wildlife Biologist | James Davis, Wildlife Team Manager |
| 01 | 25/08/2020 | Pest Animal Monitoring Program Draft.R1 | Ellie Kirke, Graduate Wildlife Biologist | Bree Galbraith, Lands Protection Officer (GRC)<br>James Davis, Wildlife Team Manager | James Davis, Wildlife Team Manager |
| 02 | 3/09/2020 | Pest Animal Monitoring Program | Ellie Kirke, Graduate Wildlife Biologist | Bree Galbraith, Lands Protection Officer (GRC)<br>James Davis, Wildlife Team Manager | James Davis, Wildlife Team Manager |
| 03 | 10/09/2020 | Pest Animal Monitoring Program | Ellie Kirke, Graduate Wildlife Biologist | Bree Galbraith, Lands Protection Officer (GRC)<br>Justin Sanderson<br>Senior Environmental Officer (TMR)<br>James Davis, Wildlife Team Manager | James Davis, Wildlife Team Manager |
| 04 | 08/12/2021 | C2CD Offset Pest Animal Monitoring Program | | Jess Bracks, Principal Wildlife Biologist | |

## Distribution List

| Copy # | Date | Type | Issued to | Name |
|---|---|---|---|---|
| 1 | 08/12/2021 | Electronic | Department of Transport and Main Roads | Justin Sanderson |
| 2 | 08/12/2021 | Electronic | Ecosure | Administration |

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