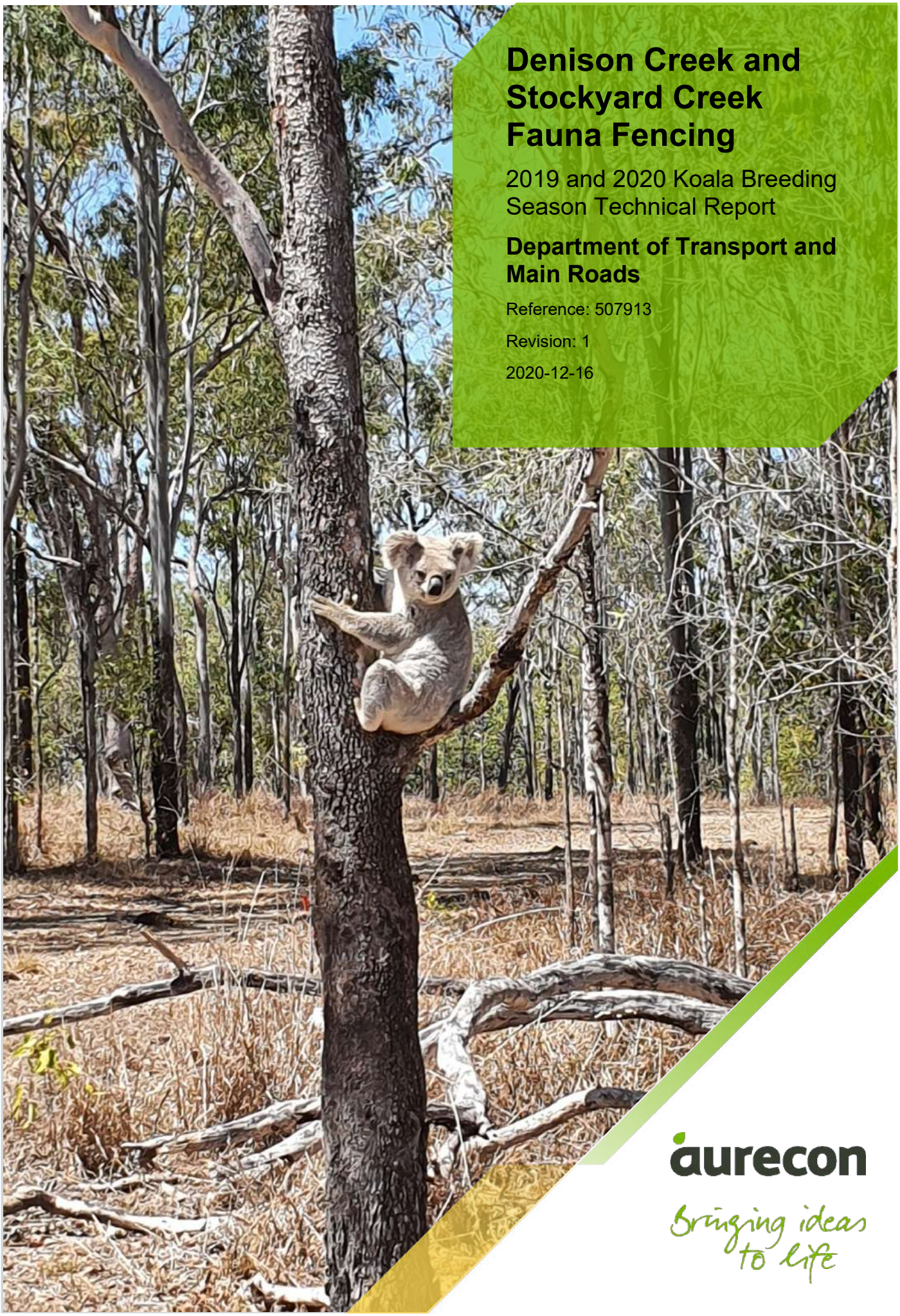

Denison Creek and Stockyard Creek Fauna Fencing

2019 and 2020 Koala Breeding Season Technical Report

Department of Transport and Main Roads

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Document control record

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Executive summary

Introduction

On behalf of DTMR, Aurecon have undertaken a two-year program for the monitoring, analysis, and reporting of the fauna exclusion fencing located at the Denison Creek and Stockyard Creek Bridges. The purpose of this program was to determine the effectiveness of the exclusion fencing in minimising fauna mortality and providing safe passage for koalas (*Phascolarctos cinereus*, listed as vulnerable under the *Nature Conservation Act 1992* (NC Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)) and other wildlife between habitat on either side of the road.

This report presents a detailed analysis of the results from both years of monitoring at Denison Creek, and the results from one year of monitoring at Stockyard Creek. The effectiveness of fauna exclusion fencing in directing fauna towards the crossing area is discussed, and limitations observed during the monitoring project as well as recommendations for potential future monitoring projects are presented.

The two study areas, the bridges at Denison Creek and Stockyard Creek, are located on the Peak Downs Highway between Eton and Nebo, approximately 60 km south west of Mackay, on the Clarke-Connors Range.

Methodology

The initial monitoring period took place from 19 November to 18 December 2019, encompassing the known koala breeding season (August to December) at Denison Creek. The 2020 monitoring period took place from 31 August to 2 October 2020 at Denison and Stockyard Creek.

The monitoring program was undertaken in accordance with the *Wildlife Protection Monitoring and Assessment Plan* (DTMR 2020). Four main detection methods have been incorporated into the monitoring and assessment, including sand plots and infrared camera traps (checked every 2-3 days during the monitoring period) as well as scat detection, incidental sightings and roadkill which were recorded when sighted.

Results

Koala tracks

During the 2019 monitoring period at Denison Creek there were 38 records of koala tracks, with the majority found on the sand plots located within the creek bed. There was one successful funnel (where tracks indicated the fence had directed wildlife towards the creek bed), and 13 successful crossings (where tracks identified as the same assumed animal were found in both sand plots underneath the bridge).

During the 2020 monitoring period at Denison Creek there were 51 records of koala tracks, with the majority again found on the sand plots located within the creek bed. There were four successful funnels, and 17 successful crossings. At Stockyard Creek there were seven records of koala tracks, four of those in the creek bed. There were two successful funnels, but no successful crossings.

There were no significant differences found in the number of koala tracks recorded at Denison Creek between the two years, while significantly fewer tracks were recorded at Stockyard Creek in 2020 compared with Denison Creek in 2020. However, it should be noted that only the northern approach to Stockyard Creek had been fitted with fauna exclusion fencing. There were no significant differences found in the number of successful funnels between the two years at Denison Creek.

Incidental sightings

Nine sightings of live koalas, and 10 koala roadkill were recorded at Denison Creek in 2019.

Four sightings of live koalas were made at Denison Creek in 2020 - two between Denison and Stockyard Creek, and 17 at Stockyard Creek (including several repeat sightings of an adult female and juvenile koala).

There were eight roadkill records made between the two monitoring periods along the Peak Downs Highway, with an additional eight made during the 2020 monitoring period.

There were no significant differences found between the number of sightings of live koalas inside the exclusion fences, and within the road corridor (on the ‘road’) over the two years. Neither was there a significant difference in the roadkill recordings during either monitoring period. There were, however, significantly fewer roadkill recorded prior to the breeding season than during.

Discussion

In addition to recordings of tracks on the plots inside of the exclusion fencing, koalas have been recorded travelling outside of the exclusion fencing (in the road corridor). Half of these records show koalas travelling toward the end of the exclusion fencing, which indicates that the koalas were attempting to reach the other side of the fence. The lack of corresponding roadkill records indicates that they are able to safely navigate their way out of the fenced road corridor.

Behaviour of koalas at the sand plots may indicate that the visible camera flash may disturb koalas and cause them to abandon the crossing. However, other recordings of active koalas from the same location, on a later date, indicated no perturbation from the flash possibly suggesting habituation to the flash.

The effectiveness of the fauna exclusion fencing at Denison and Stockyard Creek is positive in preventing or reducing koala road deaths along the crossing area. In excess of 80 successful crossings are expected each breeding season at Denison Creek. While the installation of the fencing has not eliminated koala roadkill at either location, nor has it provided evidence that suggest koalas utilise the creek bed specifically to avoid traffic, the monitoring program has demonstrated that koalas regularly utilise the areas within the creek beds to cross the highway safely.

The installation of additional fauna exclusion fencing along the Peak Downs Highway would likely significantly increase the effectiveness in providing a benefit for the wider population in the Clarke-Connors Range.

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Camera and plot locations, Denison 2019

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1 Introduction

1.1 Background

The Department of Transport and Main Roads (DTMR) completed the Eton Range Realignment Project (the Project) in September 2020, which upgraded the range crossing from two to four lanes. This reduced the grade over the range and improved safety for heavy vehicles and all other traffic through control of approach and departure speeds.

In 2015, the former federal Department of the Environment (DoE, now the Department of Agriculture, Water and the Environment, DAWE) declared the Project a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This was due to the potential for significant residual impacts on koala (*Phascolarctos cinereus*) and koala habitat because of the Project's construction and operation (potential significant impacts to Matters of National Environmental Significance (MNES) protected under Section 18 and 18A, Part 3 of the EPBC Act).

In 2016 DoE granted the project approval with conditions. One of these conditions (Condition 6) required residual impacts to be offset through a two-year research project, relating to koala ecology and conservation management in the surrounding Clarke-Connors Range. This study was completed by the Central Queensland University (CQU) in March 2019. For the study, previous research on koala habitat usage, and population estimates in the region were reviewed (Meltzer and Tucker, 2011). Koalas were radio-collared, which provided insights into koala ranging behaviour around the Nebo to Eton stretch of the Peak Downs Highway (Ellis et al,2018). Modelling was done on the presence of koala road-kill hotspots on the Nebo to Eton stretch of the Peak Downs Highway (Schlagloth 2018). This prompted the consideration for installation of wildlife barrier fencing (fauna exclusion fencing) and the availability of underpasses using existing infrastructure (Melzer and Black,2018).

Following the research project, koala sensitive infrastructure (fauna exclusion fencing) was to be placed at strategic locations along the Eton to Nebo portion of the Peak Downs Highway, based on findings of koala habitat use and movement patterns. The fencing was installed to address a portion of the 'Denison Creek cluster' (C6), and the 'Stockyard Creek cluster' (C8), which were identified as a high priority due to the high number of koalas sighted and recorded near the watercourse (see Melzer (2017) and Melzer and Black (2018) and references therein). This resulted in the construction of approximately 1,677 m of fauna exclusion fencing at the Denison Creek Bridge on the Peak Downs Highway in June 2019. In the autumn and winter of 2020, approximately 1,300 m of fauna exclusion fencing was installed at the southern approach to Stockyard Creek Bridge on the Peak Downs Highway. Additional fauna exclusion fencing was also installed at Cut Creek, Boundary Creek, Lonely Creek and Fiery Creek in 2020. Monitoring of this infrastructure did not form part of this project's scope.

As recommended within Aurecon's 2019 interim monitoring report, fauna fence returns (where the end of the fencing is used to guide fauna to the vegetated side of the fence) have been incorporated into the Stockyard Creek design. Termination of the fauna exclusion fencing occurred just east of the gravel storage pad area near where two private accesses intersect the Highway.

1.2 Purpose

On behalf of DTMR, Aurecon have undertaken a two-year program for the monitoring, analysis, and reporting of the fauna exclusion fencing located at the Denison Creek and Stockyard Creek Bridges. The purpose of this program was to determine the effectiveness of the exclusion fencing in minimising fauna mortality and providing safe passage for koalas and other wildlife between habitat on either side of the road. The monitoring program was undertaken in accordance with the *Wildlife Protection Monitoring and Assessment Plan* (DTMR 2020) (the Plan), which was developed to comply with Condition 12 of EPBC 2015/7552 Approval:

> *Within 12 months of expending funds to design, construct and implement wildlife protection and/or diversion infrastructure as described under Condition 11, the approval holder must provide to the*

Department and publish on the approval holder's website, a report on the nature of the wildlife protection and/or diversion infrastructure funded and a plan for monitoring and assessing the effectiveness of this infrastructure in delivering a conservation gain for the koala. The published report must remain on the approval holder's website for the life of approval.

The overall aims of this monitoring project are as follows:

- Determine the effectiveness of the erected fencing in diverting koalas to safe passage underneath the highway
- Identify any potential flaws with the fauna sensitive infrastructure that may reduce its ability to exclude koalas from the road reserve which can be improved upon and applied to future infrastructure in the region as well as the existing infrastructure
- Gain a greater understanding of temporal movement patterns of koalas near the infrastructure
- Determine whether the erection of fencing along the Highway is likely to improve the viability of the regional koala population, thereby determining whether any conservation gain has been achieved. **Conservation gain** as defined within the EPBC conditions is *the benefit delivered to the koala species including by averting loss caused by vehicle strike, improving habitat connectivity, and improving habitat quality*.

The field work component of the program consisted of two monitoring periods over two consecutive koala breeding seasons. This is in accordance with the Plan, as detailed in Section 3.

This report presents a detailed analysis of the results from both years of monitoring at Denison Creek, and the results from one year of monitoring at Stockyard Creek. Statistical analyses are presented of fauna crossings, incidental sightings and roadkill. The analysis includes rates of crossing across the taxa detected during the surveys. The effectiveness of fauna exclusion fencing in directing fauna towards the crossing area is discussed. Limitations observed during the monitoring project as well as recommendations for potential future monitoring projects are presented.

1.3 Project Location

The Project is located south west of Mackay on the Peak Downs Highway. The highway is part of the Emerald to Mackay freight corridor supporting the mining and agricultural industries of the Bowen and Galilee Basins, across the Clarke-Connors Range.

The two study areas, the bridges at Denison Creek and Stockyard Creek, are located on the Peak Downs Highway between Eton and Nebo, approximately 60 km south west of Mackay (see Figure 1).

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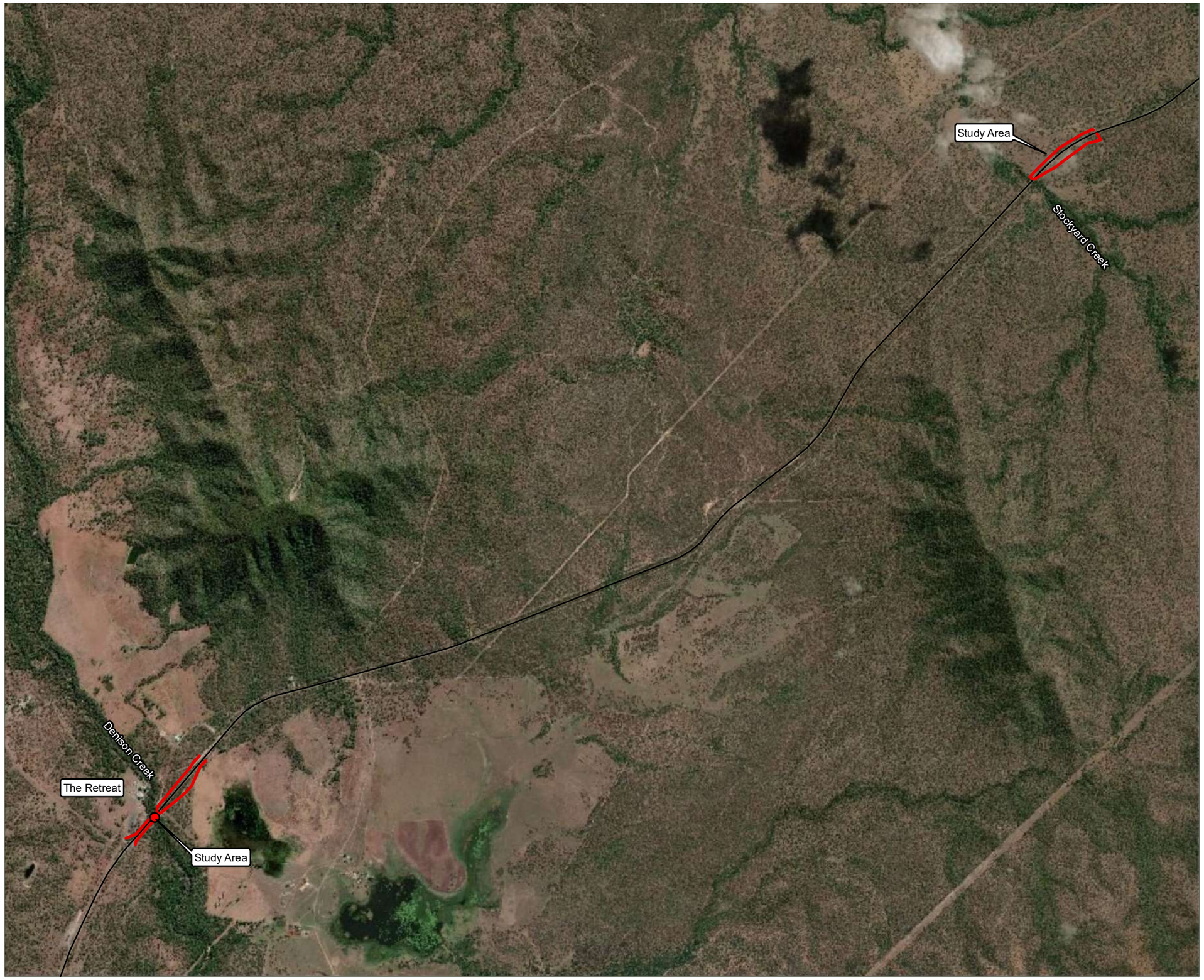
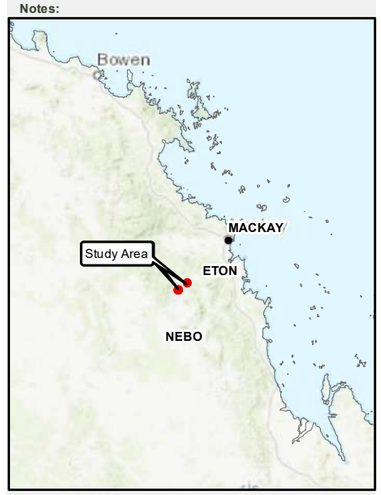


Legend

- Fauna Fencing
- Queensland Road Network

Notes:



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Denison Creek and Stockyard Creek Fauna Fencing 2020 Technical Report

Figure 1: Locality

2 Koalas on the Clarke-Connors Range

2.1 General

Koalas are listed as vulnerable under the *Nature Conservation Act 1992* (NC Act) and the EPBC Act. Although the extent of the national population has reduced, they are relatively widespread throughout eastern Queensland (Melzer et al, 2018), which includes the population on the Clarke-Connors Range.

The CQU Research Project found the koalas on the Clarke-Connors Range to be generally healthy, while smaller (females 4.5kg - 6.8 kg; males 5.5 kg - 9.1 kg) than those in populations further south (Ellis et al, 2018). Their preferred trees, for both shelter and food, were observed to be *Eucalyptus tereticornis* (Queensland blue gum), *E. crebra* (narrow-leaved ironbark), and *E. platyphylla* (poplar gum) (Ellis et al, 2018).

2.2 Habitat

At Denison Creek, the vegetation is dominated by *Corymbia tessellaris* (Moreton Bay ash)*, Eucalyptus raveretiana* (black ironbox), *Melaleuca* sp. and rainforest elements in a stream-fringing forest. Adjacent broad alluvial flats support a tall open woodland of *E. tereticornis, E. platyphylla, C. tessellaris* and *C. dallachyana* (Dallachy's gum). Open forest of *E. platyphylla, E. tereticornis, E. drepanophylla* (narrow-leaved ironbark*)* and *C. tessellaris* are found on adjacent undulating low rises, lower slopes and associated low ridges (Meltzer and Black, 2018).

At Stockyard Creek, vegetation is dominated by stream-fringing rainforest communities with emergent *C. tessellaris. E. tereticornis, E. drepanophylla* open forest is present on adjacent low hills (Meltzer and Black, 2018).

Overall population data within the region is limited to a study by Melzer and Tucker (2011) which estimated a population at St Lawrence, a coastal region approximately 120 km south of Denison Creek, on the Bruce Highway, to contain around 1,440 individuals. There have been no formal population estimates of the Clarke Connors Range population.

2.3 Movement patterns

While occasionally active during the day, koalas are generally mobile between sunset and sunrise. The study undertaken by CQU involved radio-tracking of 10 koalas fitted with transmitting collars, over a period of two years (August 2016 to August 2018, Ellis et al 2018). The results indicated that overnight movements ranged from 20 m to 150 m, and recorded home ranges varied from 1.5 ha up to 113 ha (Ellis et al 2018, Melzer et al 2018). Multiple crossings of the Peak Downs Highway were recorded. Several koalas were found to rarely (if at all) cross the Peak Downs Highway, while others crossed at multiple locations. At least one koala was actively appearing to choose to travel along the creek bed at Denison Creek as opposed to over the road (Ellis et al 2018).

2.4 Threats

Threats to koalas include habitat loss, natural disasters and climate change, diseases, predation, and vehicle collisions (Melzer et al 2018). Schlagloth (2018) showed where there is a higher koala habitat ranking (ie more food) near roads, there is an increased occurrence of roadkill. Changes to the alignment of the Peak Downs Highway (duplication of carriageways, installation of overtaking lanes) and/or increases in traffic volumes have potential impacts on koala populations through both habitat loss and increased incidence of vehicle collisions.

The fauna exclusion fencing has been installed to guide fauna (koalas, specifically) under the bridges at Denison Creek and Stockyard Creek and reduce the roadkill impacts on the local koala population, as well as other fauna.

3 Methodology

3.1 General

3.1.1 Monitoring period 2019

The monitoring of the sand plots was performed by a team of suitably qualified ecologists / environmental scientists. Monitoring occurred three times in each of the monitoring weeks (on Monday, Wednesday and Friday).

At Denison Creek, the initial monitoring period took place from 19 November to 18 December 2019, encompassing the known koala breeding season (August to December). Although five weeks were originally proposed, due to time constraints, only four weeks could be achieved during this monitoring period. The final week included only two monitoring days due to significant rainfall damaging the sand plots on the second-last monitoring day (see Section 4.4). This resulted in a total of 10 monitoring events at Denison Creek in 2019.

At the conclusion of the 2019 monitoring period, Aurecon recommended to commence monitoring earlier in the breeding season, to avoid the increased summer temperatures which caused the sand to dry out (making tracks more difficult to discern), and to avoid the higher likelihood of rain damaging sand plots (ie recommended starting in August/September).

3.1.2 Monitoring period 2020

For the 2020 monitoring season the same methodology was adopted as described for 2019, and recommendations based on the previous year's observations were implemented. The 2020 monitoring period took place from 31 August to 2 October 2020 at Denison and Stockyard Creek. Establishment of the sand plots was arranged by DTMR. Monitoring was originally planned to commence 24 August 2020, however, was delayed by one week due to the use of overly coarse plot material, which needed to be replaced. The first monitoring day was spent smoothing sand plots and establishing cameras, so only 14 monitoring days (spanning five weeks) were achieved at both Denison Creek and Stockyard Creek for 2020.

3.1.3 Methodology overview

Four main detection methods have been incorporated into the monitoring and assessment, including:

1. Sand plots (see Section 3.2.1) – checked every 2-3 days after initial deployment, with three monitoring days per week.
2. Camera traps (see Section 3.3.1) – motion sensor and infrared wildlife cameras installed around sand plot locations; photos downloaded every 2-3 days when checking sand plots.
3. Scat detection – incidental if recorded on or adjacent to sand plots and cameras.
4. Incidental sightings and roadkill – recorded if koala roadkill were sighted from Eton to the site along the Peak Downs Highway, and near Denison and Stockyard Creek Bridge. Additionally, incidental sightings of live koalas and koala scats within or near the study area were recorded.

The above methods are further described in the following sections. Examples of setup of sand plots and cameras are shown in Figure 2 and Figure 3, including the cattle exclusion fencing (see Section 3.2.3).

Figure 2: Setup example of sand plots, cameras, and barbed wire fencing at Denison Creek (Plot 6)

Figure 3: Setup example of sand plot, camera, and barbed wire fencing at Stockyard Creek (Plot 16)

3.2 Sand plots

3.2.1 Setup

To monitor the movements of koalas and other fauna, sand plots were installed inside the fauna exclusion fencing. Sand plots provide a soft, even, surface in which animals leave footprints or tracks (see Mawson and Orell 2010). These tracks can then be used to identify the animals that have crossed the plot and are ideal for monitoring nocturnal or 'secretive' animals such as koalas.

Denison Creek

For both the monitoring periods at Denison Creek, 10 sand plots were installed near or under the bridge and perpendicular to the fauna exclusion fencing, as displayed in Figure 4 and listed below:

- Two long plots over the width of the creek (except for the low flow channel) measuring approximately 50 m long and 1.5 m wide (see Figure 2)
- Four small plots on the stepped platforms at each of the two bridge abutments (two on each abutment). These plots were approximately 2 m long and 1.5 m wide,
- Four sand plots, on both sides of the road corridor, and both ends of the fencing. These plots were approximately 2 m long and 1.5 m wide

Stockyard Creek

For the monitoring period at Stockyard Creek in 2020, six sand plots were installed near or under the bridge and perpendicular to the fauna exclusion fencing, as displayed in Figure 5 and listed below:

- Four plots over the width of the creek (except for the low flow channel) measuring approximately 2 m long and 1.5 m wide
- Two sand plots, one on either side of the road corridor, along the fencing. These plots were approximately 1.5 m wide and 2 m long (see Figure 3)

3.2.2 Sand selection

For installation of the sand plots, DTMR arranged for RoadTek to assist with importing clean and weed-free fine sand from a local provider. Black plastic was laid under the sand, to avoid growth through the sand plot and retain moisture as much as possible. No bait was used to attract animals to or over the plots. The sand plot setup is displayed in Figure 2 and Figure 3.

Following the 2019 monitoring period, Aurecon recommended mixing sand plot material with finer materials (ie add clay to mix) to increase the water holding capability and improve the clarity of fauna tracks. This was implemented for the 2020 monitoring period at both Denison and Stockyard Creek.

3.2.3 Cattle exclusion fencing

During the early stages of the monitoring at Denison Creek in 2019, it was found that at times there was high disturbance of the sand plots by cattle traversing through the area. The movement of cattle through the plots hampered the identification of other tracks. To limit this for the remainder of the monitoring period, Aurecon installed additional barbed wire fencing around the sand plots on 2 December 2019 (monitoring week 2), as shown in Figure 2 and Figure 3.

While the temporary fencing stops large animals, such as cattle, it still allows safe passage of smaller animals (ie koalas and macropods). Identical fencing was installed by RoadTek for the 2020 monitoring period at both Denison and Stockyard Creek.

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Legend

- Camera Locations
- Sand Plot
- Fauna Fencing

Notes:

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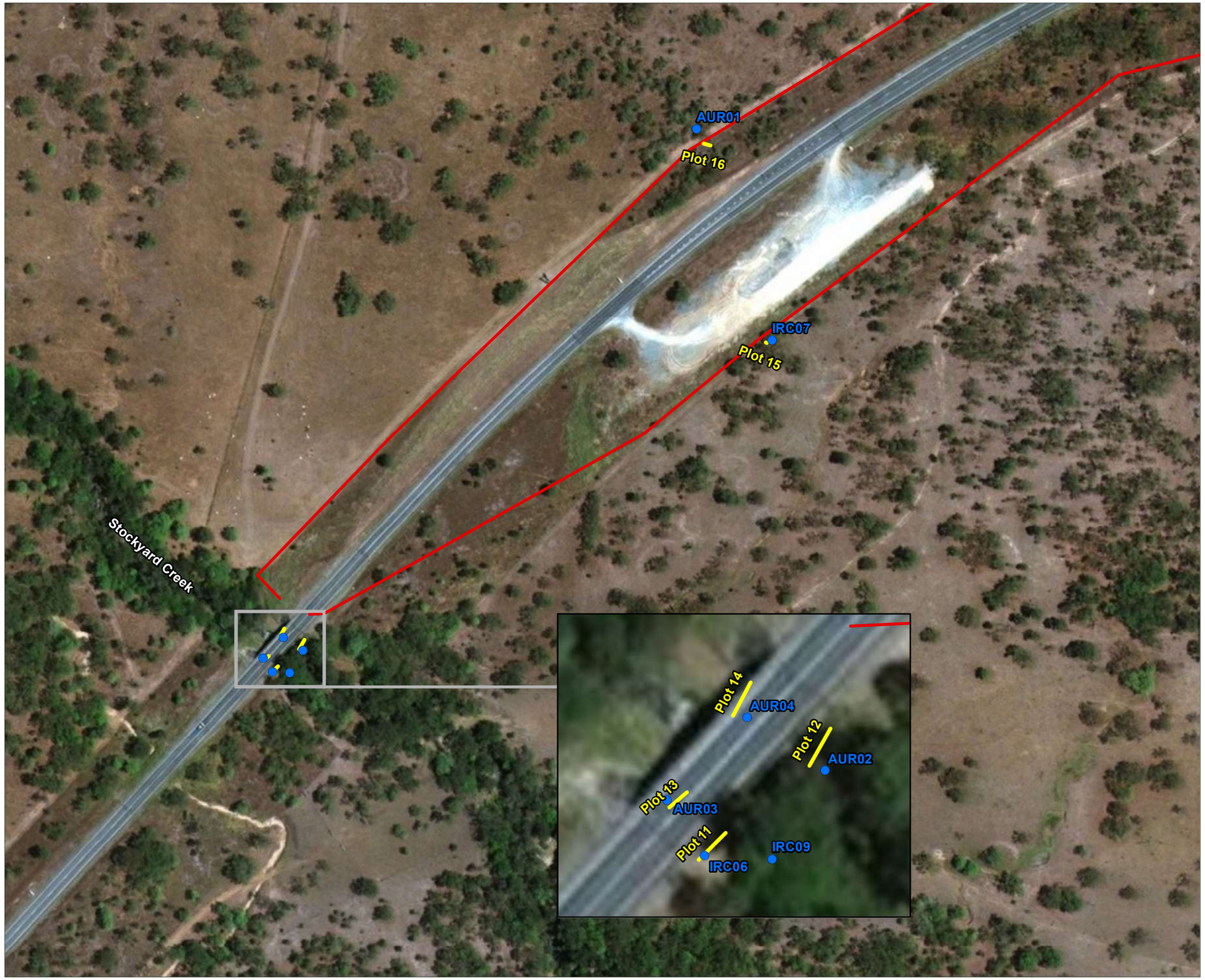
Denison Creek and Stockyard Creek Fauna Fencing 2020 Technical Report

Figure 4: Sand Plot, Camera and Fauna Exclusion Fencing, Denison Creek



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Legend

- Camera Locations
- Sand Plot
- Fauna Fencing

Notes:

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Coordinate System: GDA 1994 MGA Zone 55

Denison Creek and Stockyard Creek Fauna Fencing 2020 Technical Report

Figure 5: Sand Plot, Camera and Fauna Exclusion Fencing, Stockyard Creek

3.2.4 Monitoring

A list of the sand plots and associated motion sensor cameras is provided in Table 1 and Table 2. At each monitoring day, all data was downloaded from the cameras, and all sand plots were checked and smoothed out.

Table 1: Sand plots and camera traps at Denison Creek

Plot Name	Camera ID 2019	Camera ID 2020	Description
Plot 1	IRC 01	IRC04	Near entrance to The Retreat, west of Denison Creek, along the northern fence line.
Plot 2	IRC 02	IRC03	Opposite side to The Retreat entrance, west of Denison Creek, along the southern fence line
Plot 3	AUR 03	AUR10	Eastern (Eton) side of Denison Creek, along the southern fence line.
Plot 4	AUR 04	AUR05	Eastern (Eton) side of Denison Creek, along the northern fence line.
Plot 5	AUR 05, 06	AUR08, IRC01	Long plot under the bridge to the south-east, along the southern fence line.
Plot 6	AUR 02, AUR 08, AUR 09	AUR07, IRC02	Long plot under the bridge to the north-west along the northern fence line.
Plot 7, 8	IRC 03 (to replace malfunctioning camera AUR10)	AUR09	Under the second abutment (Nebo side of bridge, south-west).
Plot 9, 10	AUR 07	AUR06	Under the first abutment (Eton side of bridge, north-east).
	AUR 01	-	No sand plot associated – along the northern fence line to creek bed, past plot 4

Table 2: Sand plots and camera traps at Stockyard Creek

Plot Name	Camera ID 2020	Description
Plot 11	IRC06, IRC09	On the southern side of the bridge, on the western side of Stockyard Creek
Plot 12	AUR02	On the southern side of the bridge, on the eastern side of Stockyard Creek
Plot 13	AUR03	On the northern side of the bridge, on the eastern side of Stockyard Creek
Plot 14	AUR04	On the northern side of the bridge, on the western side of Stockyard Creek
Plot 15	IRC10 (to replace malfunction cameras IRC05, and IR07)	Along the southern fence line on the eastern side of Stockyard Creek
Plot 16	AUR01	Along the northern fence line on the eastern side of Stockyard Creek

The plots were checked for tracks along the full length, and where koala tracks were found details were recorded. This included the size of the prints (with photos taken of a measuring tape alongside the track),

and direction of travel. For tracks of other fauna species, their broad group was noted (eg birds, macropods). Where species-specific tracks were clear, these were more specifically identified (eg echidna). Tracks were interpreted using Triggs (2004) and Aurecon personnel experience.

If tracks were unclear (either through softness of the sand, other tracks overlaying, or wind disturbance) water was sprayed over the track to increase the contrast of the indentations. If this did not clarify the track, no results were recorded. Where required, photos were taken of the tracks for identification later. If more than one set of koala tracks were found on a plot, this was noted. However, if more than one set of non-target species tracks (eg birds, macropods) were present, the tracks for these were only recorded once.

After completion of each monitoring event the sand plots were smoothed out using trowels to ensure a clean start for the next day of monitoring.

3.3 Camera traps

3.3.1 Setup

Camera trap deployment is designed to aid in species-level identification of crossing attempts. Infrared, motion sensor cameras with either a black flash (collecting covert, black and white nocturnal images) or white flash (collecting colour nocturnal images) were utilised to capture still images and videos of wildlife. The purpose of the cameras was to provide more species-specific detail and provide additional information on fauna passage times (ie night or day) which cannot be determined from the sand plots.

Wildlife cameras are generally designed for close animal movement, and as such wildlife crossings may not be recorded where animals cross at larger distances from the deployed cameras. The location of cameras was assessed during initial site investigation, and additional cameras were included to those required by the original proposal, to better capture wildlife movement throughout the site.

In total 12 infrared cameras were installed within the study area at Denison Creek in 2019 (the locations are displayed in Table 1 and Figure 4 (for 2020 only) and Appendix E for 2019 camera locations. An example of the camera setup is shown in Figure 3.

For the 2019 monitoring period, nine Reconyx UltraFire cameras, and three Bushnell Trophy Cam cameras were installed at Denison Creek. One Reconyx camera (AUR10) was found to be malfunctioning during the monitoring period (false triggers), which was replaced on 3 December 2019 by a Bushnell camera (IRC03).

For the 2020 monitoring period, 10 infrared cameras were installed at Denison Creek. Noting that the camera not associated with any plot in 2019 (AUR01) was not setup for 2020 as no koalas were recorded on the plot and the camera was required for monitoring at Stockyard. These cameras installed at Denison included six Reconyx UltraFire cameras, and three Bushnell Trophy Cam cameras. To ensure cameras were not disturbed by cattle moving through the creek bed, the cameras were installed within the barbed wire fencing (see Section 3.2.1).

At Stockyard Creek seven infrared cameras were installed. These included four Reconyx UltraFire cameras, and three Bushnell Trophy Cam cameras. The initial setup included only six cameras. An additional camera was installed on Plot 11 to increase coverage of the plot. One of the Bushnell cameras (IRC05) was found to be malfunctioning during the monitoring period (flash stopped working), which was replaced on 21 September 2020 by a Bushnell camera (IRC10). This same camera was found to malfunction (false triggers), which was replaced on 30 September 2020 by another Bushnell camera (IRC07). Aurecon's methodology of checking camera data during each monitoring visit ensured that deleterious impacts to the survey results were minimised.

3.3.2 Monitoring

The photos from the cameras were collected after every visit to limit the data stored on the cards. Where possible the photos were checked in the field, to confirm tracks found on the plot and confirm effective use and placement of cameras. The cameras were then re-armed prior to leaving the site.

3.4 Incidental sightings and roadkill

For both years, during the site visits and travel to and from Mackay, records were taken of incidental koala sightings. These included scats, live animals, and roadkill individuals. GPS locations were noted in Collector for ArcGIS, and roadkill records were also uploaded to biocollect.ala.org, under 'Koala Mapping in the Mackay & Whitsundays Areas', managed by Fauna Rescue Whitsunday.

Where observed during the site visit, GPS locations of koala scats were recorded along with the location, photo, date and time found.

3.5 Definition of successful crossings

3.5.1 General

The results from the 2019 monitoring period are presented in Section 4. The results from the 2020 monitoring period are presented in Section 5 for Denison Creek and Section 6 for Stockyard Creek. Statistical analyses and comparisons of results between years and sites are presented in Section 7.

3.5.2 Koala crossings

The Plan defines crossings for tracks recorded underneath the bridges as follows:

- **Successful crossing:** Where tracks identified as the same assumed animal are found in both sand plots underneath the bridge.
- **Undetermined crossing:** Where tracks of one assumed animal are found on one sand plot underneath the bridge, but not on the other. The animal may have crossed in an unmonitored area (ie on the bridge abutment, or within the low flow channel).

Direction of wildlife movement along the fauna exclusion fencing was recorded to determine whether the fencing was effective at funnelling wildlife towards the crossing. Tracks for these fence sand plots were separated into two classifications:

- **Successful funnel:** Where tracks showed fencing directing wildlife towards the creek bed.
- **Unsuccessful funnel:** Where tracks showed fencing directing wildlife away from the creek bed.

3.5.3 Limitations

The following limitations were found with the monitoring of successful crossings and funnels:

- The definition as used above for a successful crossing has limitations. For example, due to the distance between plots under the bridge at Denison Creek (Plots 5 and 6), it is difficult to confirm that the tracks that were recorded belonged to the same koala, if the crossing was not also recorded by cameras.
- Installation of sand plots was not possible in, for example, low flow channels where water was present, or where bridge abutments were too steep/rocky.
- It is possible that koalas may have been funnelled towards the creek but did not walk along the fence line to get there (ie crossing sand plot). The koalas may have walked some distance from the fence but remained parallel with it.
- Only the northern approach at Stockyard Creek has been fenced.

4 Results 2019 – Denison Creek

4.1 Koala crossings

4.1.1 General

Koala tracks were recorded using both the sand plots and the camera traps. In total there were 38 recordings of koala tracks on the sand plots at Denison Creek in 2019 (displayed in Figure 6), with six video and/or photo records of koalas. There were no koala tracks recorded on Plots 1, 2 and 4 during 2019. Video and photo records of koala traverses were most successful (in number of fauna captures) under the abutments where koalas were forced to traverse in a confined space.

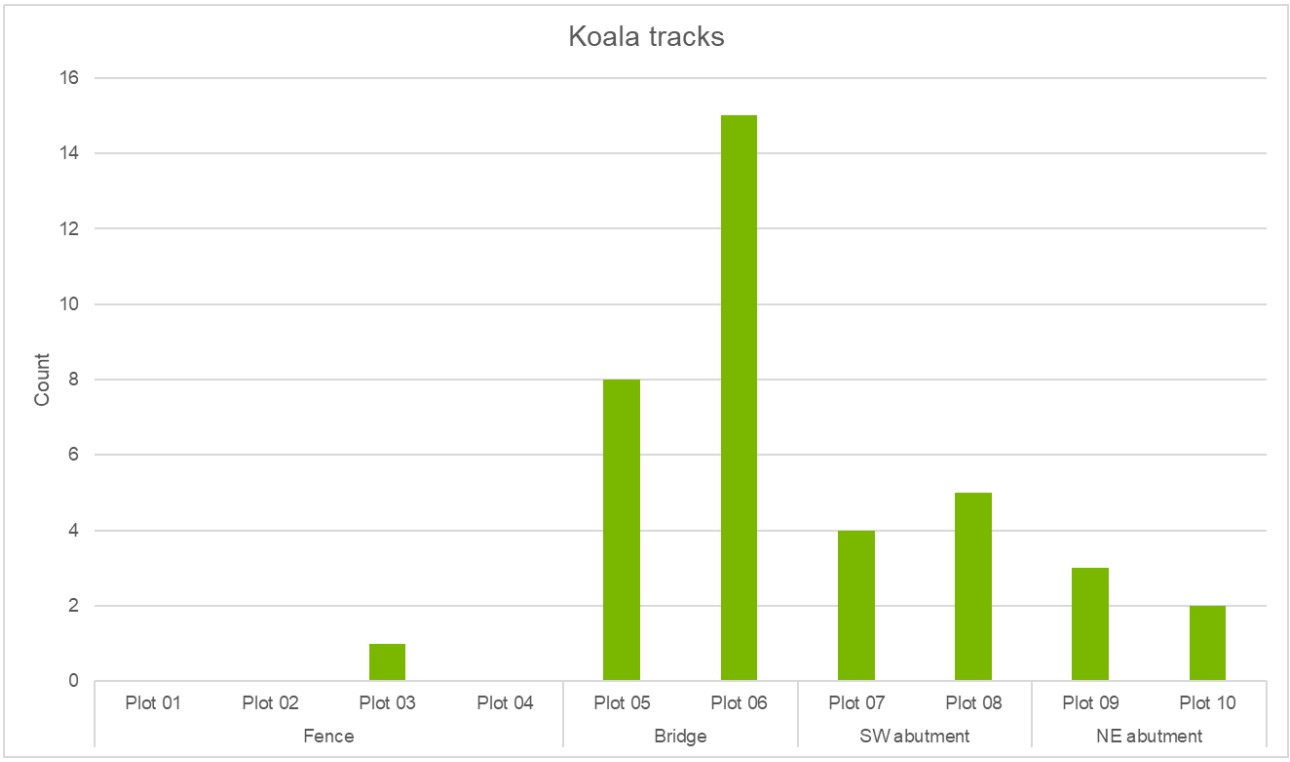


Figure 6: Recorded koala tracks on sand plots, Denison Creek 2019

4.1.2 Funnelling

In the 2019 monitoring period, there were no recordings of koala tracks on Plots 1, 2 and 4, located along the fence line. Plot 3 had one koala track. This traverse was in a south-westerly direction, which indicated a successful funnel (see Section 3.5.2 for definitions) (for photos, see Appendix B: Cameras, AUR03, 20191129).

4.1.3 Crossings

The largest number of koala tracks were recorded on Plot 6, followed by Plot 5. These are the long plots in the creek bed at Denison Creek (see Figure 4 for plot locations). A total of 13 successful crossings (where koala tracks were found on two corresponding sand plots (ie plots 5/6, 7/8, 9/10) were recorded (see Section 3.5.2 for definitions).

Figure 7 shows the koala crossings where tracks were recorded on corresponding plots. Where the travel directions on corresponding tracks were not identical (ie one track going in a north-westerly (NW) direction

and the other going in a south-easterly (SE) direction) these were not counted as successful. Similarly, where tracks were only recorded on one of the two corresponding plots (ie tracks on Plot 5, but not on Plot 6) these were not counted as a successful crossing and are not included on the figure.

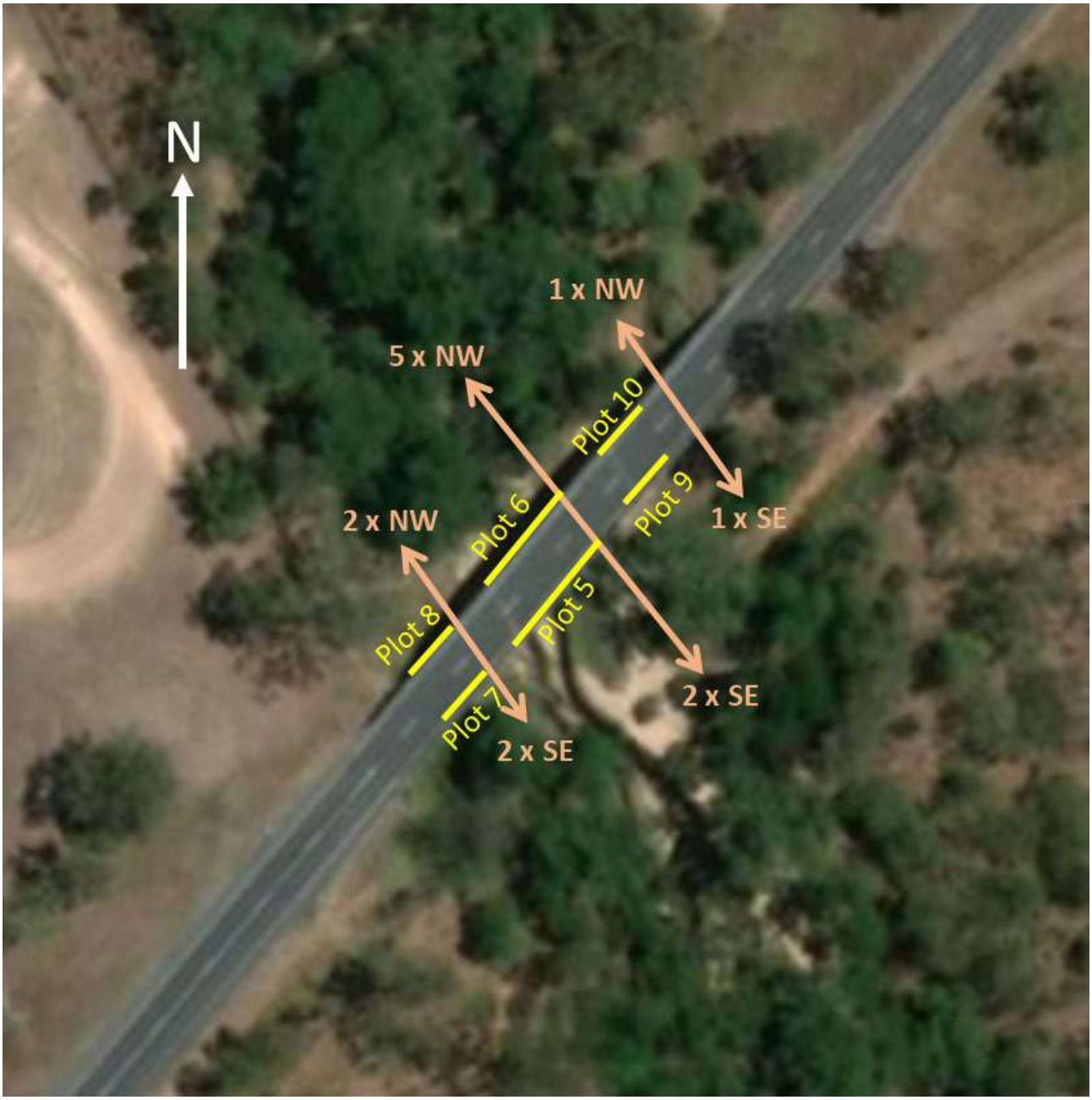


Figure 7: Koala crossings at Denison Creek 2019, showing travel directions over corresponding sand plots

Most of the successful crossings of koalas over Plot 5 and Plot 6 (the long sand plots in the creek bed) were outside of the trigger areas for the cameras. There was only one video/photo record of a successful crossing at Plots 7 and 8 under the abutment (see Appendix B: Cameras, AUR07, 20191209, several photos).

There was one occasion (at Plot 9, under the abutment, on 3 December) where koala tracks were found on the plot going in several directions. Scuff marks on the sand plot also indicated the koala had sat down in the sand. This was captured by the camera traps (see Appendix B: Cameras, AUR07, 20191204, several photos). No corresponding tracks were found on Plot 10, so this was recorded as an undetermined crossing.

4.2 Other species

Additional fauna taxa found on plots and cameras were as follows:

- Birds (Torresian crow (*Corvus orru*), Australian magpie (*Cracticus tibicen*), nankeen night heron (*Nycticorax caledonicus*), bar-shouldered dove (*Geopelia humeralis*), duck sp.)
- Cattle (*Bos taurus*)
- Dog (domestic, *Canis lupus familiaris*)
- Echidna (*Tachyglossus aculeatus*)
- Feral cat (*Felis catus*)
- Goannas/lace monitor (*Varanus* spp., including *V. varius*)
- Lizard or skink (including water dragon (*Intellagama lesueurii*))
- Macropod
- Northern Brown Bandicoot (*Isoodon macrourus*)
- Common brushtail possum (*Trichosurus vulpecula*)
- Rodent
- Snake

A photo report of representative camera trap captures is presented in Appendix B – Photo reports. A full list of species found through sand plots, camera trapping and incidental sightings is presented in Appendix C.

Figure 8 presents an overview of the frequency of recordings of tracks of other species recorded on the sand plots over the monitoring period. This shows that macropods were the most abundant (with 84 records), followed closely by birds (66 records). As with the koala tracks, Plots 5 and 6 (in the creek bed) were most frequently used (50 and 55 records, respectively, of a total of 246 records in 2019).

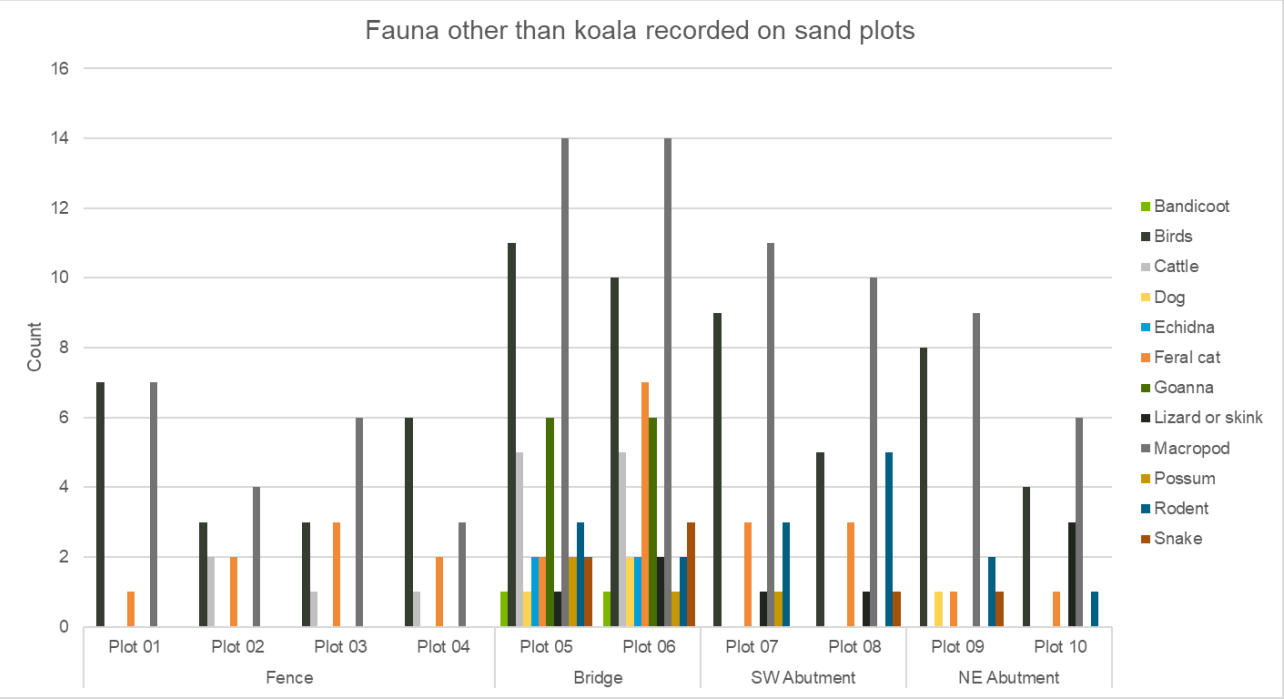


Figure 8: Tracks recorded for other species (non-koala), Denison Creek 2019

Other tracks observed, not recorded or shown on the graph, belonged to beetles and other insects. Additionally, there were two observations of bats, on Plots 6 and 7. On Plot 6 a dead microbat was found on 29 November. On Plot 7 these observations were scats from microbats that roost under the bridge, immediately above the plot.

4.3 Incidental Sightings and Roadkill

4.3.1 Live koalas

During the 2019 monitoring period, a total of nine sightings of live koalas were made (refer Figure 9 for locations). Four of these were within the extent of the fauna exclusion fencing. Three sightings were made in bushland inside the fauna exclusion fencing – one within the Retreat area (near Plot 1), one next to the Denison Creek bridge (in *C. tessellaris*), and one on the Eton side of Denison Creek, along the northern fence line. One sighting was recorded outside of the fauna exclusion fencing (in the road corridor). Five sightings of live koalas were recorded outside the extent of the fauna exclusion fencing, to the north-east.

4.3.2 Roadkill

From July 2019 through to the end of the 2019 monitoring period within the koala breeding season, 10 koala roadkill were recorded (by Aurecon and others) along the Peak Downs Highway – from 6 km north of Stockyard Creek to the Retreat at Denison Creek (see Figure 10). Over the 2019 monitoring period (November – December) three koala roadkill were recorded within this extent. Two koala roadkill were recorded by the Aurecon team (see Figure 10). One of the roadkill individuals recorded by Aurecon was found within the road corridor just outside of the installed fauna exclusion fencing at Denison Creek, while the other was on the southern side of the Stockyard Creek bridge. The Stockyard Creek fauna fencing was yet to be constructed at this time.

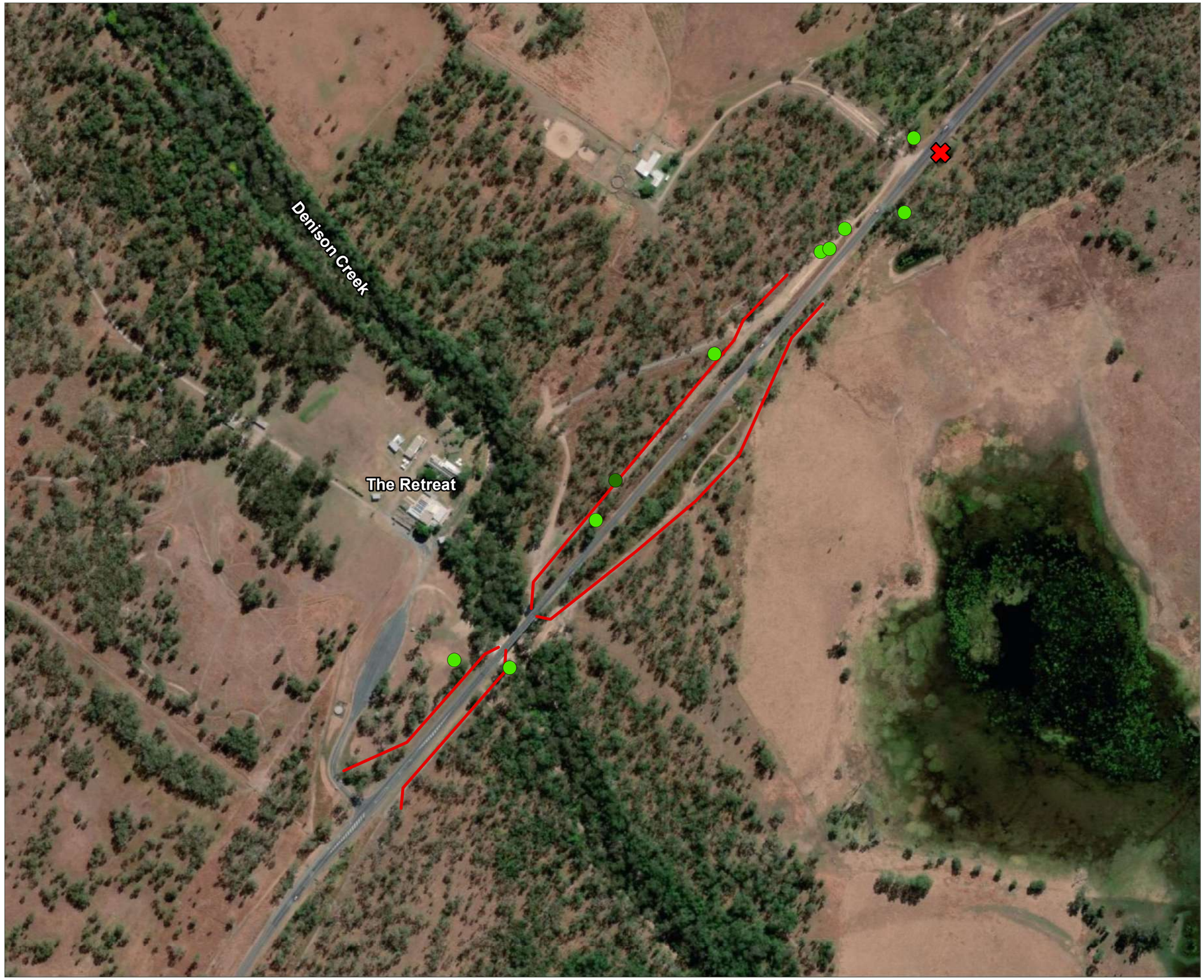
Recordings of koala roadkill after the 2019 monitoring period are presented in Section 5.3. Records of all roadkill recordings at Denison and Stockyard Creek for the 2019 and 2020 monitoring periods are presented in Appendix D.

4.4 Plot damage

During the 2019 monitoring season, plots were damaged by cattle, wasps, and rain. As mentioned in Section 3.2.1, cattle were found crossing the plots after the initial installation. Consequently, barbed wire fencing was installed on 2 December 2019, to prevent cattle accessing and damaging the plots.

Burrowing insects (wasps) caused disturbance to the two long plots (Plots 5 and 6) in the creek bed of Denison Creek, which became progressively worse over the monitoring period. This limited the identification of smaller animal tracks, particularly toward the north-eastern end of the plots, at the base of the bridge abutment. As koala tracks were still identifiable, the use of insecticide to control the wasps was not considered.

In the final week of monitoring (16 and 18 December 2019) heavy rain washed away the sand plots within the creek bed and under the abutments at Denison (see examples of Plots 10 and 6, in Figure 11). As this was the last week of monitoring and no excess sand was available for repairs, the final day of monitoring relied solely on the camera footage.



aurecon

Legend

- Incidental Sighting
- Scats
- Road kill
- Fauna Fencing

Notes:

Date: 15/12/2020 Version: 1

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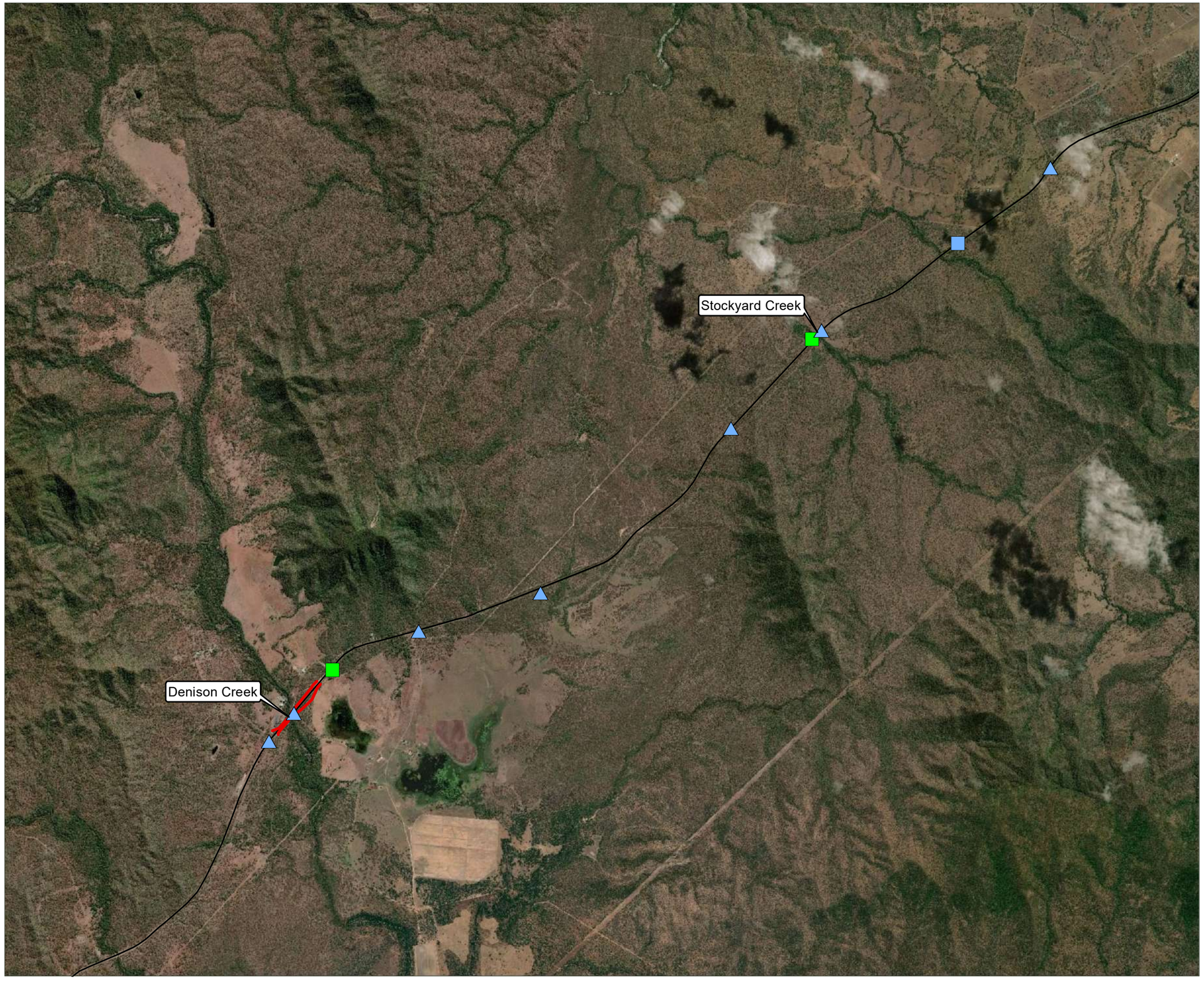
0 100 200 Metres

Job No: 507913

Coordinate System: GDA 1994 MGA Zone 55

Denison Creek and Stockyard Creek Fauna Fencing 2020 Technical Report

Figure 9: Incidental Sightings, Denison Creek 2019



aurecon

Legend

- Fauna Fencing
- Queensland Road Network

BioCollect Roadkill Records

Timing, Record By

- 2019 monitoring period, Aurecon
- 2019 monitoring period, Other
- Pre-2019 monitoring period, Other

Notes:

Date: 2/12/2020 Version: 1

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Job No: 507913

Coordinate System: GDA 1994 MGA Zone 55

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Figure 10: Koala Roadkill Records, 2019

Figure 11: Rain damage at Plots 10 (abutment) and Plot 6 (creek bed), Denison Creek

5 Results 2020 – Denison Creek

5.1 Koala crossings

5.1.1 General

Koala tracks were recorded using both the sand plots and the camera traps. In total there were 51 records of koala tracks on the sand plots in 2020 (displayed in Figure 12), with 18 video and/or photo recordings of koalas. There were no koala tracks recorded on Plots 1 and 2 during 2020. Video and photo records of koala traverses were most successful (in number of fauna captures) under the abutments where koalas were forced to traverse in a confined space.

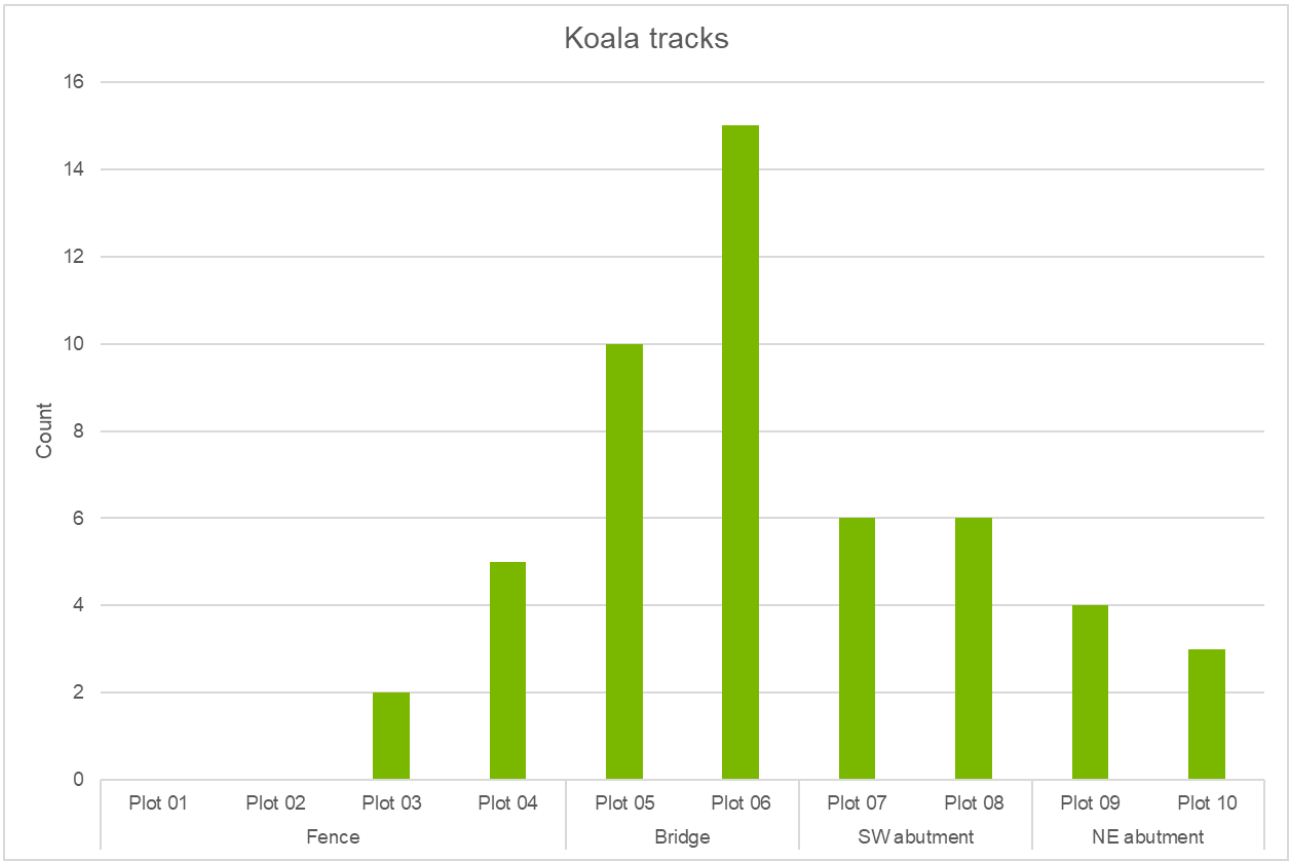


Figure 12: Recorded koala tracks on sand plots, Denison Creek 2020

5.1.2 Funnelling

In the 2020 monitoring year, there were no records of koala tracks on Plots 1 and 2, located along the fence line on the south-western side of Denison Creek (near the Retreat). There were, however, four separate occasions at which the camera at Plot 1 (IRC04) recorded koalas outside of the fauna exclusion fencing (in the road corridor), travelling along the fence line. On 14 September a koala is seen travelling in a south-westerly direction (away from Denison Creek and towards the end of the fauna exclusion fencing). On 27 September camera footage shows a koala going back-and-forth along the fence line (within the road corridor) for 15 minutes. Both the first and final photo indicates the koala is travelling in a south-westerly direction, away from Denison Creek (from 03:30 to 03:46). Then again on 27 September (between 19:06 and 22:34), and 2 October (between 22:22 and 22:51) footage indicates a koala (or possibly multiple koalas) travelling back-and-forth in the road corridor, along the fence line. For photos, see Appendix B: Cameras, IRC04, 20200927 and 20201002.

Plot 3, located on the fence on the north-eastern side of Denison Creek, southern side of road, recorded two sets of koala tracks. The first of the tracks was in a south-westerly direction (towards Denison Creek) which indicated a successful funnel (see Section 3.5.2 for definitions). For photos, see Appendix B: Cameras, AUR10, 20200910. In the second record, two sets of tracks were recorded (going in opposite directions) on 21 September. Without camera footage it would be impossible to determine in which order these tracks were made, if these tracks were made by the same animal, or even if these tracks were made on the same day/night. Results from the camara traps showed that these tracks were made on the same evening. The first set of tracks were made at 23:21, on 20 September, going in a north-easterly direction (unsuccessful funnel), and the second set of tracks were made at 00:01 on 21 September, going in a south-westerly direction (successful funnel). The size and appearance of the koala in the camera footage indicates it was likely the same animal. For photos, see Appendix B: Cameras, AUR10, 20200921.

Plot 4, located on the fence on the north-eastern side of Denison Creek, northern side of road, recorded five koala tracks. Upon comparison with camera footage it was clear that at least two of these tracks belonged to the same individual (on 6 of September) who got close to the end of the sand plot, sat down, and turned around. For photos, see Appendix B: Cameras, AUR05, 20200906. The final direction of travel was to the south-west, which has consequently become a successful funnel. Another set of tracks was recorded on 7 September, going in a south-westerly direction (a successful funnel). Two tracks (recorded on 9 and 11 September) were both going in a north-easterly direction, indicating an unsuccessful funnel. For photos, see Appendix B: Cameras, AUR05, 20200909 and 20200911.

Additional camera footage from Plot 4, on 12 September showed a koala travelling outside of the exclusion fencing, along the fence line (within the road corridor). This koala was going in a north-easterly direction, towards the end of the fauna exclusion fencing and away from Denison Creek. For photos, see Appendix B: Cameras, AUR05, 20200914.

5.1.3 Crossings

The majority of koala tracks were recorded on Plot 6 (15 tracks), followed by Plot 5 (10 tracks). These plots are in the creek bed at Denison Creek (see Figure 4 for plot locations). A total of 17 successful crossings (where koala tracks were found on two corresponding sand plots (ie plots 5/6, 7/8, 9/10), see Section 3.5.2 for definitions) were recorded in the 2020 monitoring period at Denison.

Figure 13 shows the koala crossings, where tracks were recorded on corresponding plots. Where the travel directions of corresponding tracks were not identical (ie one track going NW, the other going SE) these were not counted as successful. Similarly, where tracks were only recorded on one of the two corresponding plots (ie tracks on Plot 5, but not on Plot 6) these were not counted as a successful crossing and are not included on the figure.

There were two occasions on which a successful crossing has been recorded on camera. On 21 September 2020 two sets of koala tracks were recorded on both Plot 9 and 10 (under the abutment), going in both directions. These plots had one camera trap (Camera AUR06, recording Plot 9, with Plot 10 in the background) which captured a koala on 20 September at 01:40 travelling in a south-easterly direction, and one koala on 21 September at 00:43 travelling in a north-westerly direction. For photos, see Appendix B: Cameras, AUR06, 20200921. Video footage from the second recording shows the koala crossing Plot 9 and Plot 10.

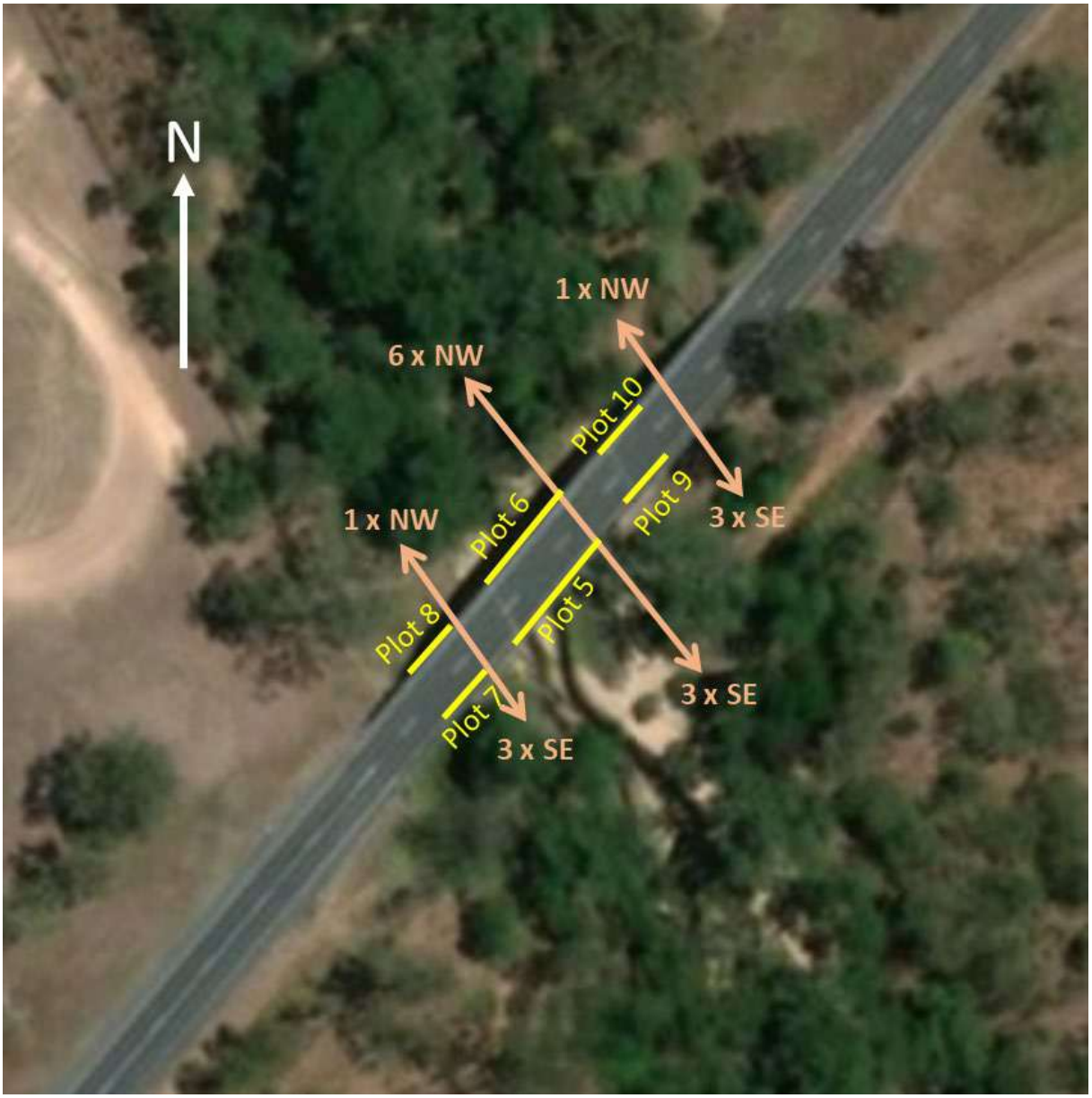


Figure 13: Koala crossings at Denison Creek 2020, showing travel directions over corresponding plots

5.2 Other species

Additional fauna taxa groups found on plots and cameras were as follows:

- Birds (Australian bustard (*Ardeotis australis*), sulphur crested cockatoo (*Cacatua galerita*), Torresian crow, galah (*Eolophus roseicapilla*), straw-necked ibis (*Threskiornis spinicollis*), Australian magpie, magpie-lark (*Grallina cyanoleuca*))
- Bat (scats)
- Cattle
- Dog
- Echidna
- Feral Cat
- Goanna
- lizards or skinks
- Long-nosed bandicoot (*Perameles nasuta*)
- Macropod
- Possum
- Rodent
- Snake

A photo report of representative camera trap captures is presented in Appendix B – Photo reports. A full list of species found through sand plots, camera trapping, and incidental sightings is presented in Appendix C.

Figure 14 presents an overview of the frequency of recordings of tracks of other species recorded on the sand plots over the monitoring period. This shows that macropods were the most abundant (with 95 records). The next most abundant species were rodents (41 records), feral cats (35 records), and birds (32 records). As with the koala tracks, the Plots 5 and 6 (in the creek bed) were most frequently used (52 and 61 records, respectively, of a total of 283 records in 2020).

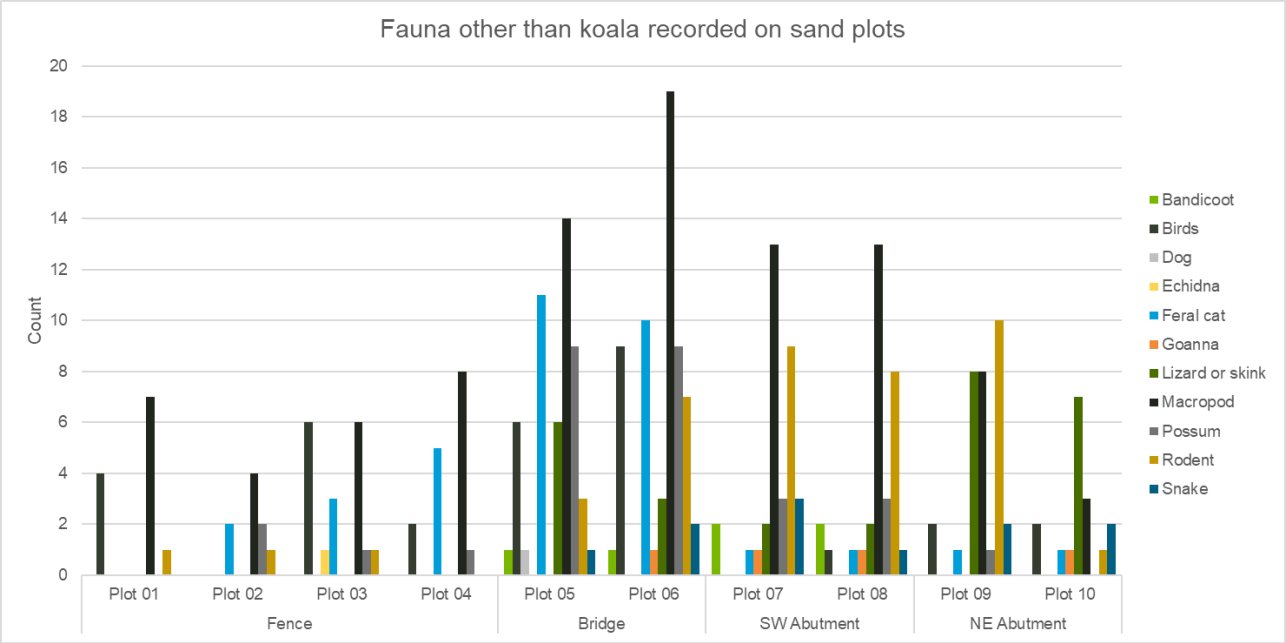


Figure 14: Tracks recorded for other species (non-koala), Denison Creek 2020

Other tracks observed, not recorded or shown on the graph, belonged to beetles and other insects. There were no cattle tracks found on the sand plots at Denison Creek in the 2020 monitoring season, indicating that the exclusion fencing was effective.

5.3 Incidental Sightings and Roadkill

5.3.1 General

Due to the proximity of Denison Creek and Stockyard Creek, incidental sightings and roadkill data from both locations are presented here. Results cover the period from end of the 2019 monitoring period to the end of the 2020 monitoring period.

5.3.2 Live koalas

During the 2020 monitoring period, four sightings of live koalas were made at Denison Creek, two sightings of live koalas were between Denison and Stockyard Creek (Figure 16), and 17 sightings at Stockyard Creek (Figure 17). The 17 koala sightings at Stockyard Creek include multiple sightings of an adult female with joey (Figure 15) that were made at the entry gate to the fenced area at Stockyard Creek (within the road corridor). The koalas at the Stockyard Creek gate were frequently seen in one of the large ironbark trees (*E. crebra*) on the northern side of the Peak Downs Highway. These trees are known to be favoured by the koalas (Property Owner, pers. comm).

Figure 15: Adult female and juvenile koala in ironbark (*Eucalyptus crebra*) at Stockyard Creek

5.3.3 Roadkill

Between the two monitoring periods (December 2019 – August 2020) there were eight roadkill recordings along the Peak Downs Highway, between Denison Creek and 6 km north of Stockyard Creek (Figure 18). Recordings in this period were predominantly made by Fauna Rescue Whitsundays, with three of the observations recorded by DTMR.

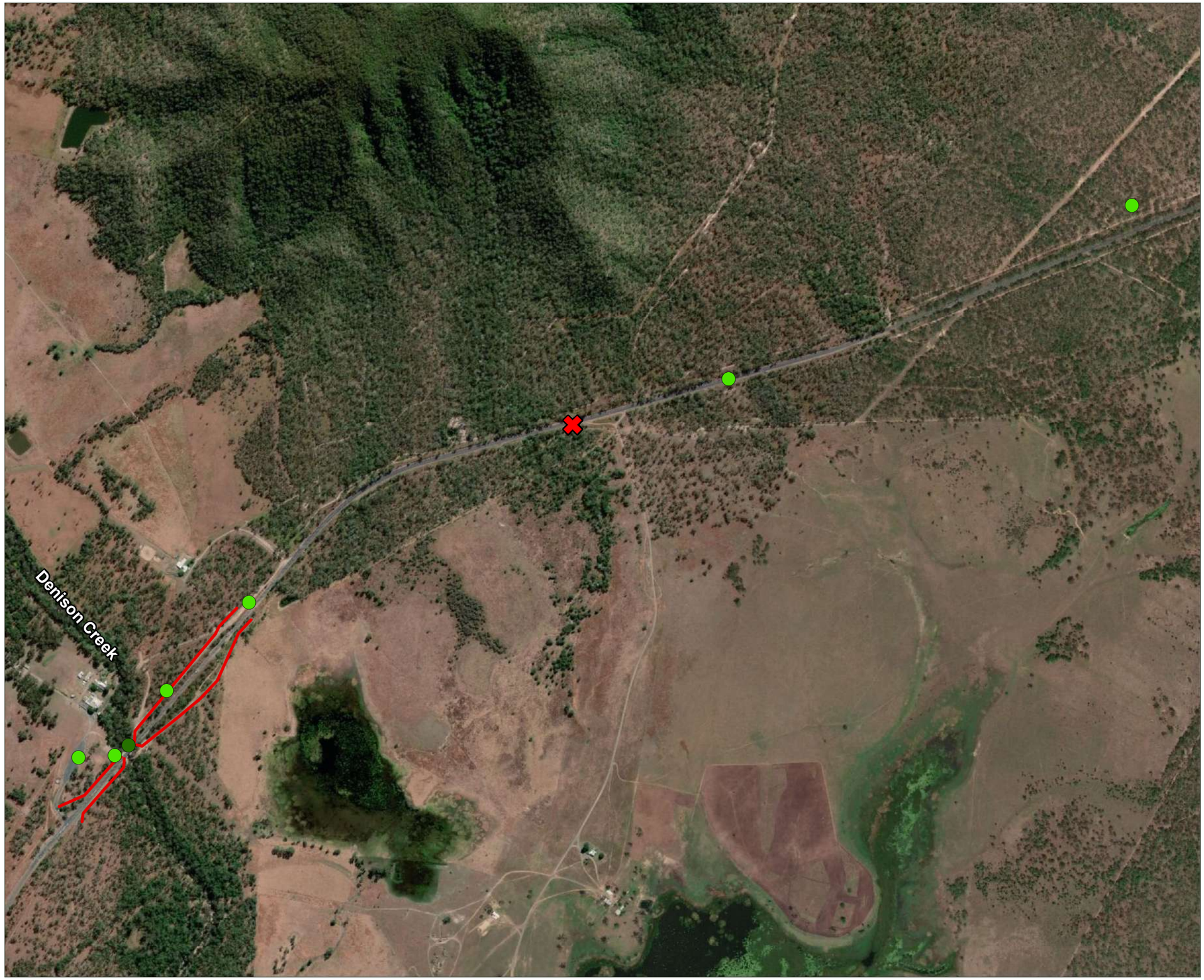
An additional eight recordings of roadkill were made during the 2020 monitoring period (up to 2 October 2020). Of these, five koala roadkill were recorded by the Aurecon team, and three by Fauna Rescue Whitsundays.

Records of all roadkill recordings at Denison and Stockyard Creek for the 2019 and 2020 monitoring periods are presented in Appendix D.

5.4 Plot damage

Rain damage occurred on the long plots (Plots 5 and 6) under the Denison Creek bridge on several days during the 2020 monitoring period. The damage was predominantly due to runoff through the bridge drainage holes (see example of Plot 5 in Figure 19). This created several sections along the whole length of the plots in which the tracks became indistinguishable. As there was no workaround for this issue, the plots were smoothed out at the end of each monitoring day, and where sand was found to have washed away, it was replaced with excess sand.

On 7 September 2020 it was found that several people had traversed the full length of Plot 6 in the creek bed at Denison Creek (Figure 20). This was likely associated with the large number of campers at a bike rally that was being held at the Retreat on the weekend of 5 September and did not occur again.



aurecon

Legend

- Incidental Sighting
- Scats
- Road kill
- Fauna Fencing

Notes:

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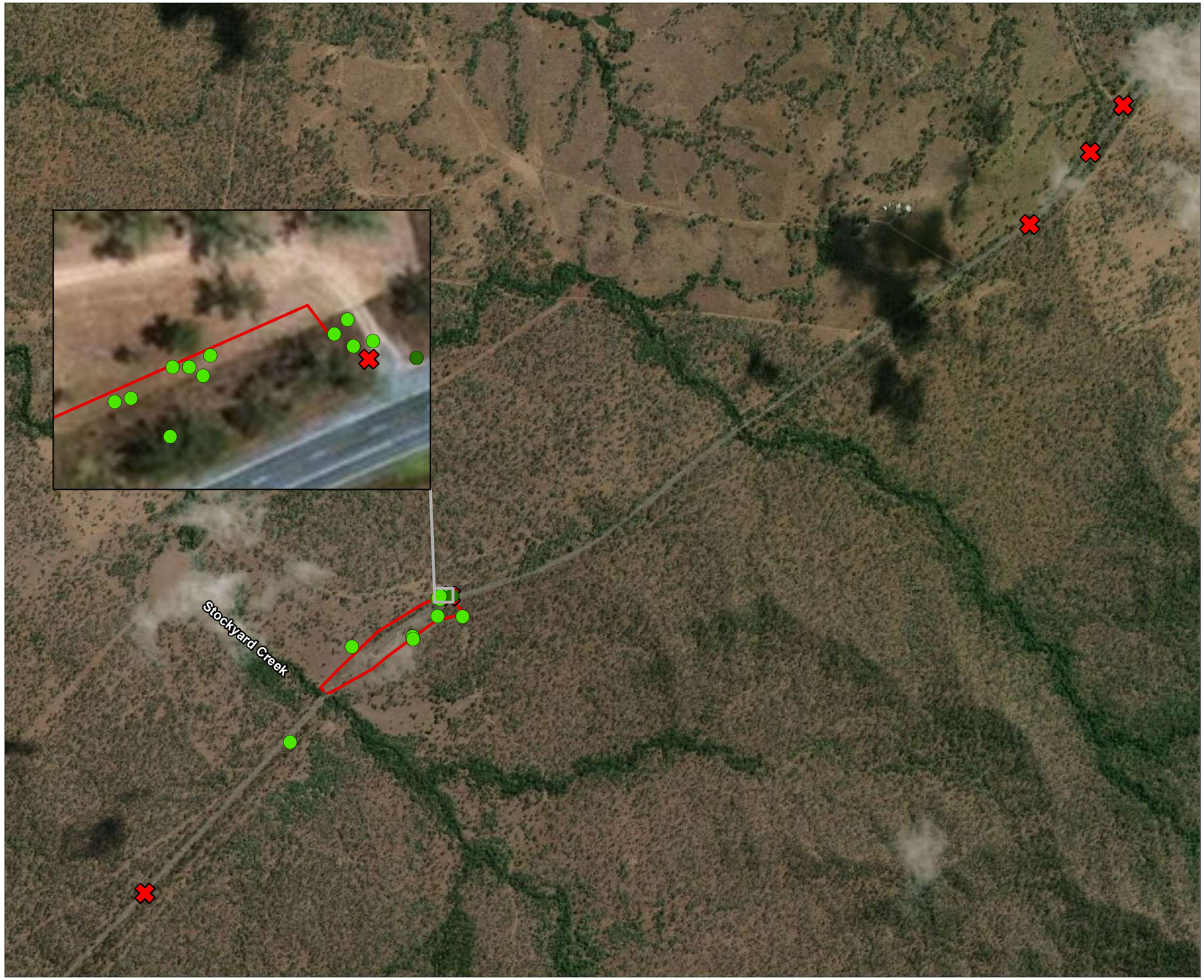
Coordinate System: GDA 1994 MGA Zone 55

Denison Creek and Stockyard Creek Fauna Fencing 2020 Technical Report

Figure 16: Incidental Sightings, Denison Creek 2020



aurecon

Legend

- Incidental Sighting
- Scats
- Road kill
- Fauna Fencing

Notes:

Date: 15/12/2020 Version: 1

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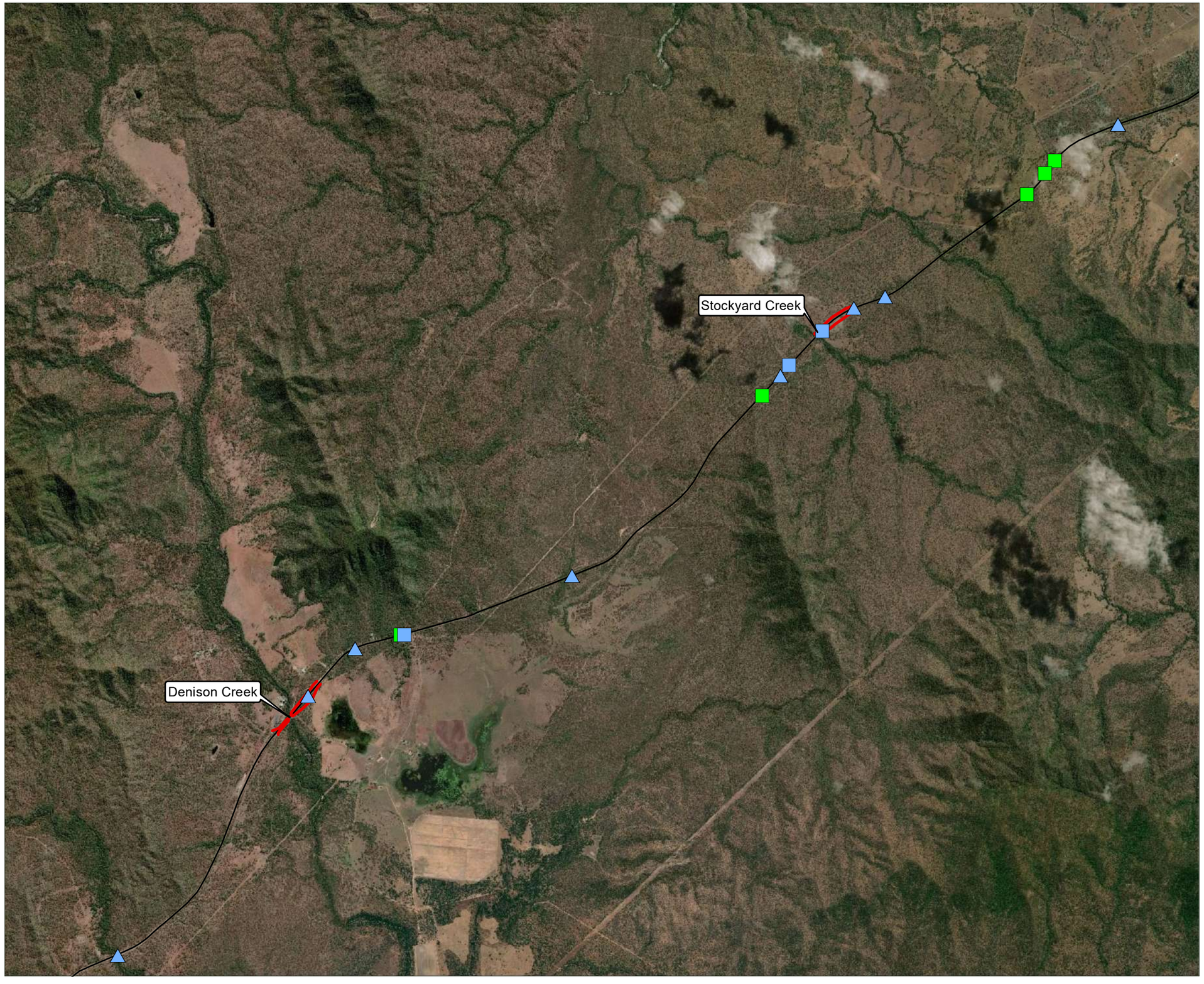
Job No: 507913

Coordinate System: GDA 1994 MGA Zone 55

Denison Creek and Stockyard Creek Fauna Fencing 2020 Technical Report

Figure 17: Incidental Sightings, Stockyard Creek 2020



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aurecon

Legend

- Fauna Fencing
- Queensland Road Network

BioCollect Roadkill Records

Timing, Record By

- 2020 monitoring period, Aurecon
- 2020 monitoring period, Other
- Pre-2020 monitoring period, Other

Notes:

Date: 2/12/2020 Version: 1

A3 scale: 1:50,000

0 1,000 2,000 Metres

Job No: 507913

Coordinate System: GDA 1994 MGA Zone 55

Denison Creek and Stockyard Creek Fauna Fencing 2020 Technical Report

Figure 18: Koala Roadkill Records, 2020

Figure 19: Rain damage at Plot 5, Denison Creek

Figure 20: People traversing the full length of Plot 6, Denison Creek (Camera AUR07)

6 Results 2020 – Stockyard Creek

6.1 Koala crossings

6.1.1 General

Koala tracks were recorded using both the sand plots and the camera traps. In total there were seven koala tracks recorded on the sand plots or camera footage in 2020 at Stockyard Creek (as displayed in Figure 21). Five video and/or photo records were made of koalas, with one of the traverses on Plot 16 not recorded on the sand plot.

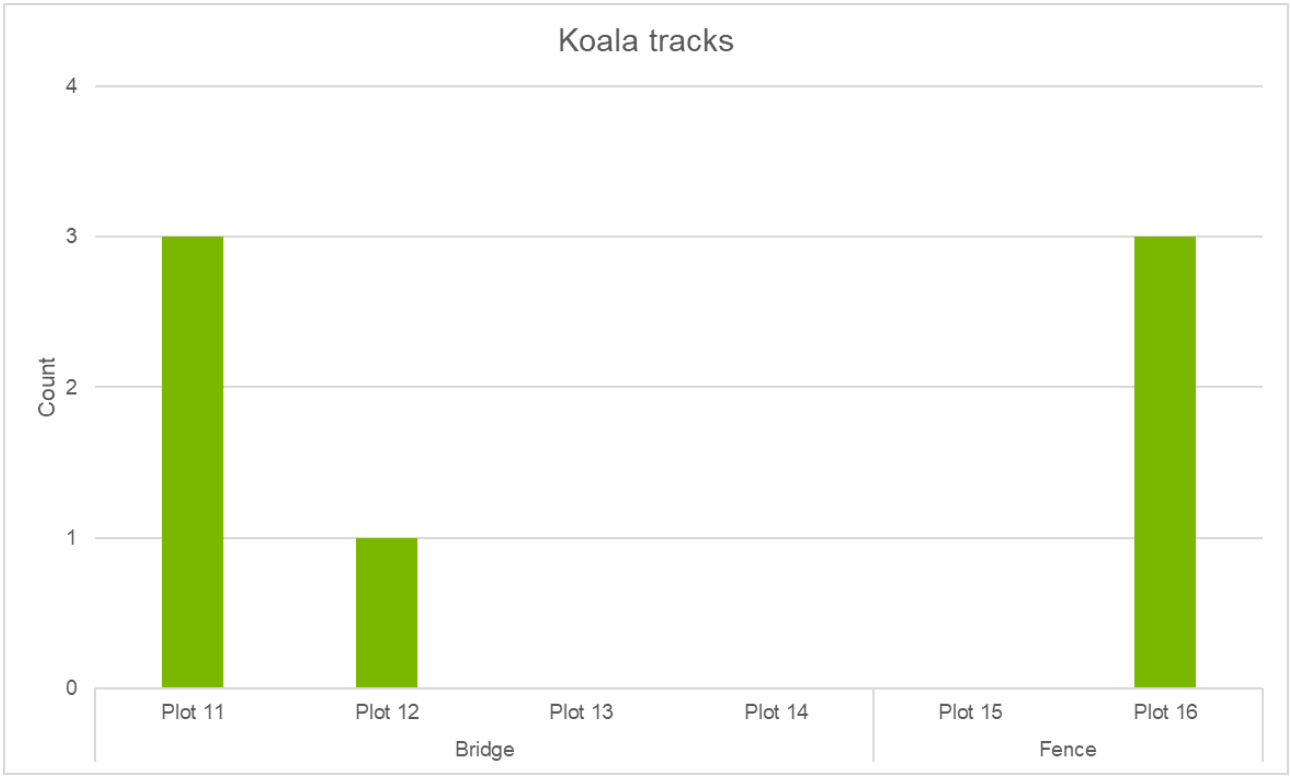

Figure 21: Recorded koala tracks on sand plots, Stockyard Creek 2020

In the 2020 monitoring year, there were no recordings of koala tracks on Plots 13, 14, and 15 at Stockyard Creek (see Figure 21). Plot 11 (three tracks recorded) and Plot 12 (one track) are set up in the creek bed of Stockyard Creek (see Figure 5 for locations), while Plot 16 (three recordings) is located along the northern fauna exclusion fence line.

6.1.2 Funnelling

The tracks on Plot 16 were verified with footage from the camera trap. This showed two traverses by a koala on 29 September, and one on 1 October. The first footage showed a koala travelling in first a south-westerly direction (on 29 September, 19:59, indicating a successful funnel) and then a north-easterly direction (29 September, at 23:45 indicating an unsuccessful funnel). On 1 October (at 01:40) a koala travelled in a south-westerly direction, again indicating a successful funnel.

6.1.3 Crossings

There were no successful crossings recorded at Stockyard Creek. All three recordings of koala tracks at Plot 11 were made on separate days (2, 14, and 18 September), with no corresponding tracks on the paired plot. These 'undetermined crossings' were possibly due to recording errors (eg caused by damage to the plot, see Section 6.4), or koalas utilising the bridge abutment / within the low flow channel, and may not be due to koalas not completing their crossing.

6.2 Other species

Additional fauna taxa found on plots and cameras were as follows:

- Birds (Bush stone-curlew (*Burhinus grallarius*), peaceful dove (*Geopelia placida*), Australian magpie, willie wagtail (*Rhipidura leucophrys*))
- Cattle
- Cane toad (*Rhinella marina*)
- Echidna
- Feral Cat
- Goanna
- Long-nosed bandicoot
- Lizards or skinks (including water dragon (*Intellagama lesueurii*), and monitor lizard)
- Macropods
- Possum
- Rodent
- Snake

A photo report of representative camera trap captures is presented in Appendix B – Photo report. A full list of species recorded through sand plots, camera trapping and incidental sightings is presented in Appendix C.

Figure 22 presents an overview of the frequency of tracks of other species recorded on the sand plots over the monitoring period at Stockyard Creek. This shows that lizards (including skinks) were the most abundant species (36 records), closely followed by macropods and cattle (23 records each). The plots in the creek bed were most frequently used (34, 28, 24, 24 records, respectively, for a total of 110 out of 139 recordings in 2020). Other tracks observed, not recorded or shown on the graph, belonged to beetles and other insects.

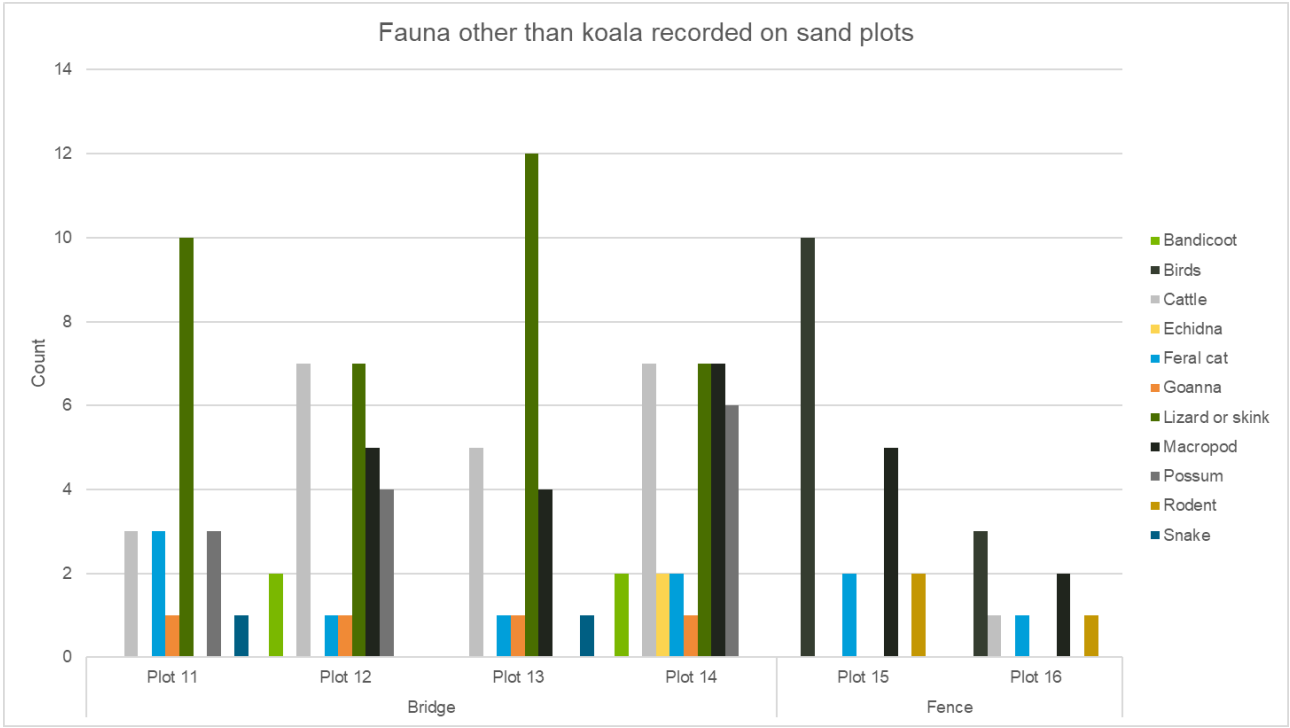

Figure 22: Tracks recorded for other species (non-koala), Stockyard Creek 2020

6.3 Incidental Sightings and Roadkill

Incidental sightings and roadkill surrounding Stockyard Creek are covered in Section 5.3. Records of all roadkill observations at Denison and Stockyard Creek for the 2019 and 2020 monitoring periods are presented in Appendix D.

6.4 Plot damage

There were two occasions at Stockyard Creek where plots were damaged to the point that no tracks could be clearly identified.

On Monday 14 September 2020, Plot 16 at Stockyard Creek (along the fence line) was found to have been destroyed by cattle, which had broken through the barbed wire fencing (Figure 23). The damaged plot (Figure 24) was repaired that day (Figure 25). The black plastic was slightly reduced in length to ensure cattle could not access it from outside the plot, and the barbed wire fencing was tightened to stop cattle from entering the plot again. This protection of this plot would have been more successful if the exclusion fencing was placed at a greater distance from the plot, however there was limited space available for the fence, which was adjacent to a vehicle access track fringed by trees.

Figure 23: Cattle within barbed wire fencing at Plot 16, Stockyard Creek (Camera AUR01)

Figure 24: Cattle damage on Plot 16, Stockyard Creek

Figure 25: Plot 16 repaired after cattle damage, Stockyard Creek

On Friday 25 September 2020, three of four plots under Stockyard Creek were damaged by heavy rainfall (see example of Plot 11 in Figure 26). The Aurecon team re-installed these plots (see example of Plot 11 in Figure 27) on Monday 28 September using excess sand left at Stockyard Creek by RoadTek.

Figure 26: Rain damage at Plot 11, Stockyard Creek

Figure 27: Plot 11 repaired after rain damage, Stockyard Creek

7 Statistical Analyses

7.1 Overview

The following sections present statistical analyses of the results from the 2019 and the 2020 monitoring periods at Denison and Stockyard Creek for the fauna exclusion fencing. This includes investigations on the differences between years and locations of occurrences of koala tracks, as well as other species, successful funnelling and the successful crossings of koalas. Additionally, incidental sightings of live koala and roadkill observations (by Aurecon and others) are analysed.

The effectiveness of the fauna exclusion fencing at Denison and Stockyard Creek (based on the results presented here) is further discussed in Section 8.3.

7.2 Koala crossings

7.2.1 Occurrence of tracks

The total number of koala tracks recorded on the sand plots at Denison Creek increased from 38 to 51, respectively between 2019 and 2020. A comparison of the 2019 and 2020 data (Figure 28) indicates comparable results between the two years. In both years, tracks were more abundant under the bridge compared to on the plots located at the fence lines. In neither year observations were made at Plots 1 and 2, along the fence line, with tracks only recorded at Plot 4 in 2020.

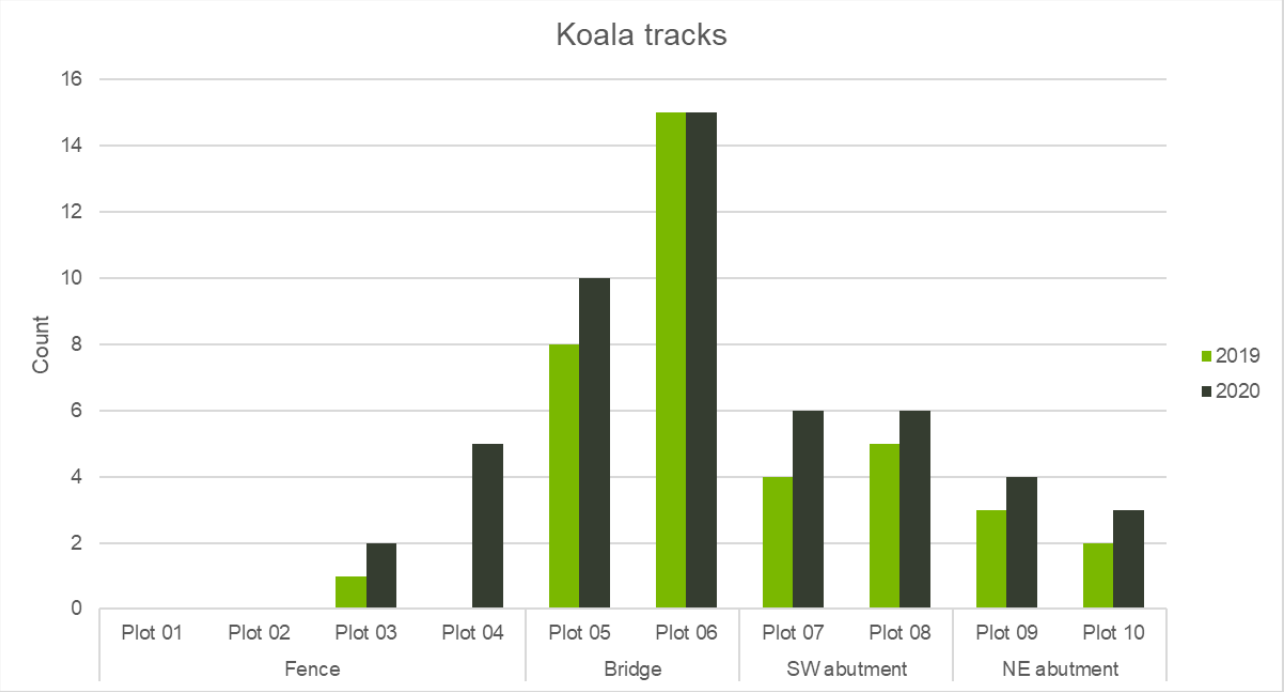

Figure 28: Koala tracks at Denison Creek in 2019 and 2020

The 2019 monitoring period consisted of four weeks, while the 2020 monitoring period consisted of five weeks. The mean number of koala tracks recorded for each monitoring period was 9.5 and 10.2 per week, respectively, for 2019 and 2020. There was, however, no significant difference found in the average number of koala tracks recorded (two-sample t-test: $p = 0.87$) at Denison Creek between the two years.

Significantly fewer koala tracks were recorded at Stockyard Creek in 2020 compared to Denison Creek in the same year (two-sample t-test: $p < 0.05$, see Figure 29). While there were 51 koala tracks recorded at Denison Creek in 2020, there were only seven koala tracks recorded at Stockyard Creek. Both locations had

five weeks of monitoring data, giving a mean number of koala tracks recorded for each location of 10.2 and 1.2, respectively, for Denison and Stockyard Creek.

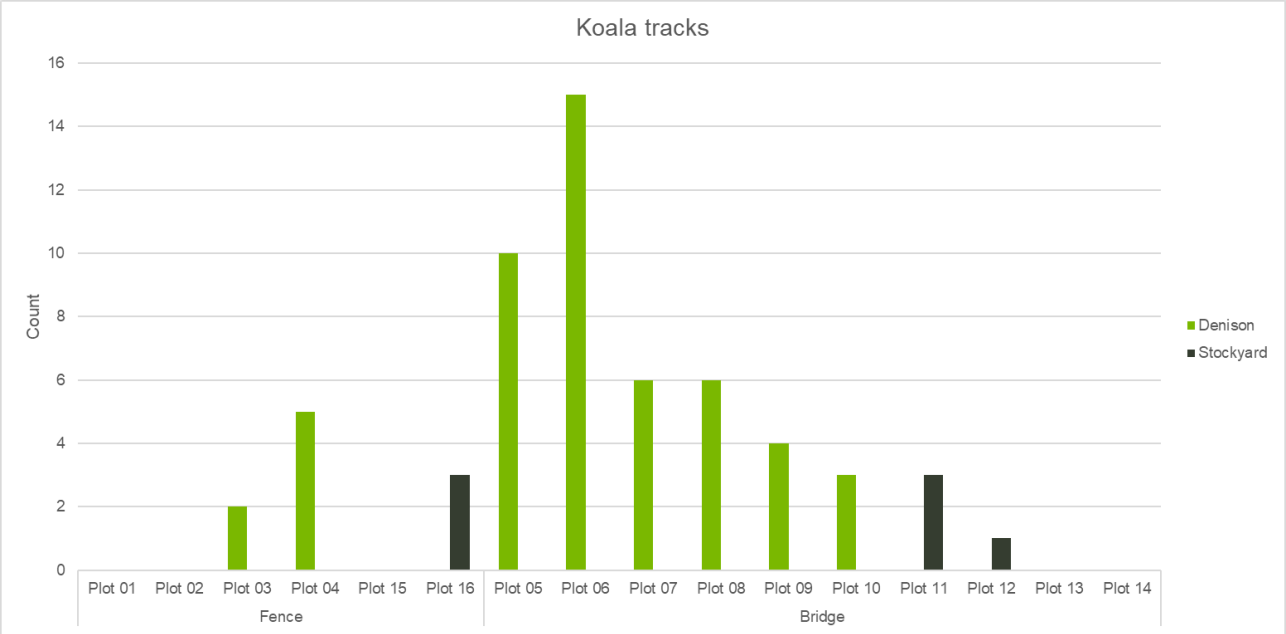

Figure 29: Koala tracks at Stockyard and Denison Creek, 2020

7.2.2 Successful funnelling

Funnelling occurred at Plots 1-4 at Denison Creek, and Plot 15 and Plot 16 at Stockyard Creek. No koala crossings were recorded at Plot 1, 2, and 15 (see Figure 30). The remaining plots had 11 tracks recorded in total, of which one was made in 2019 at Denison Creek, three at Stockyard Creek, and the remaining seven tracks were recorded at Denison Creek in 2020.

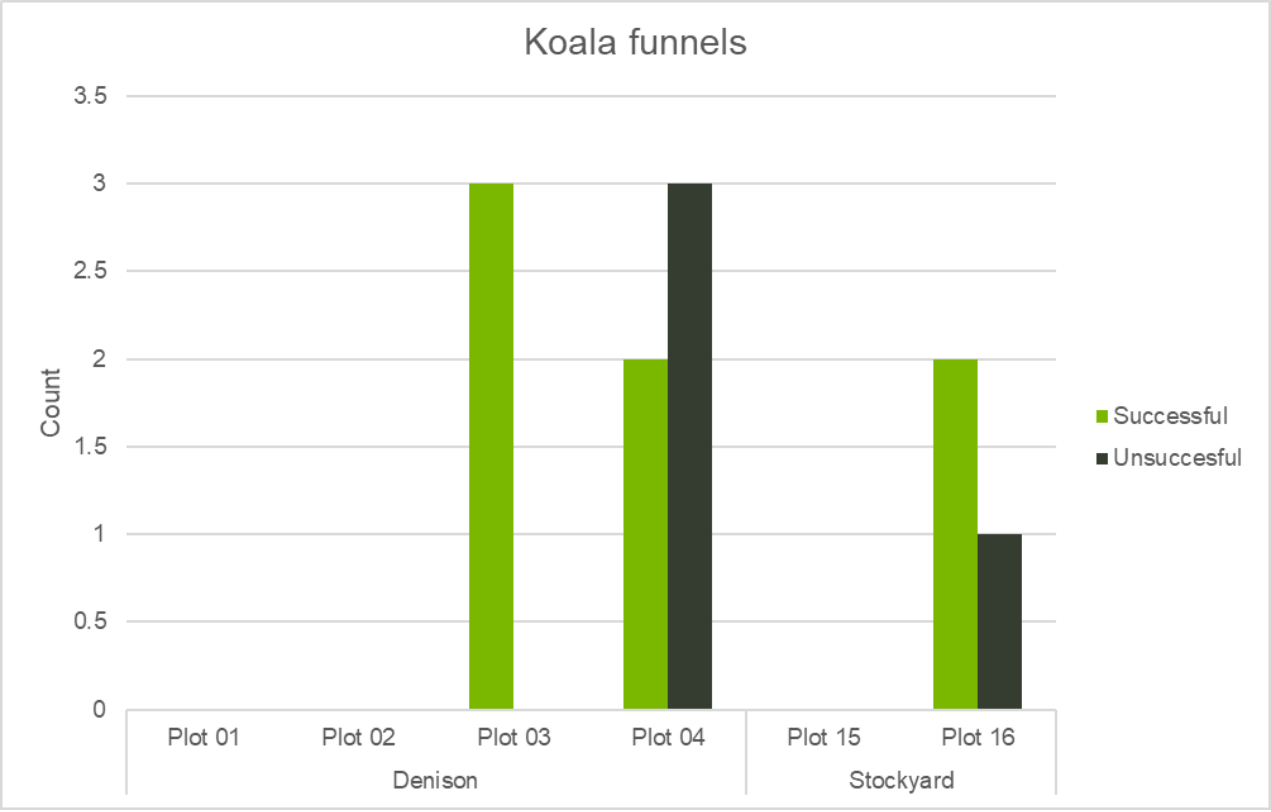

Figure 30: Comparison of successful koala funnelling at Denison and Stockyard Creek, 2019-2020

A total of seven tracks were considered to be successful funnels (Figure 30). While this constitutes 64% of all recorded funnels, there was no significant difference between successful and unsuccessful funnels (two-sample t-test: p = 0.81). The mean number of successful koala funnels recorded for each monitoring period was 0.25 and 0.8 per week, respectively, for 2019 and 2020 at Denison Creek and 0.4 at Stockyard Creek. Extrapolating this data to the entire breeding season indicates there would have likely been around seven and 21 successful funnels at Denison Creek, respectively for 2019 and 2020, and 11 at Stockyard Creek in 2020 over 26 months.

7.2.3 Successful crossings

As there were no successful crossings recorded at Stockyard Creek (see Section 6.1.3), this section will consider only the data from Denison Creek.

There were 13 successful crossings recorded at Denison Creek in 2019, and 17 successful crossings recorded at Denison Creek in 2020 (Figure 31). The mean number of successful koala crossings recorded for each monitoring period was 3.25 and 3.4 per week, respectively, for 2019 and 2020. Thus, there was no significant difference found in the number of successful crossings (two-sample t-test: p = 0.93) at Denison Creek between the two years. Extrapolating this data to the entire breeding season indicates there would have likely been around 85 and 89 successful crossings at Denison Creek, respectively for 2019 and 2020, over 26 months.

Plot 5 and 6, in the creek bed, provided the most numerous successful crossings each year (seven and nine, respectively for 2019 and 2020; Figure 31).

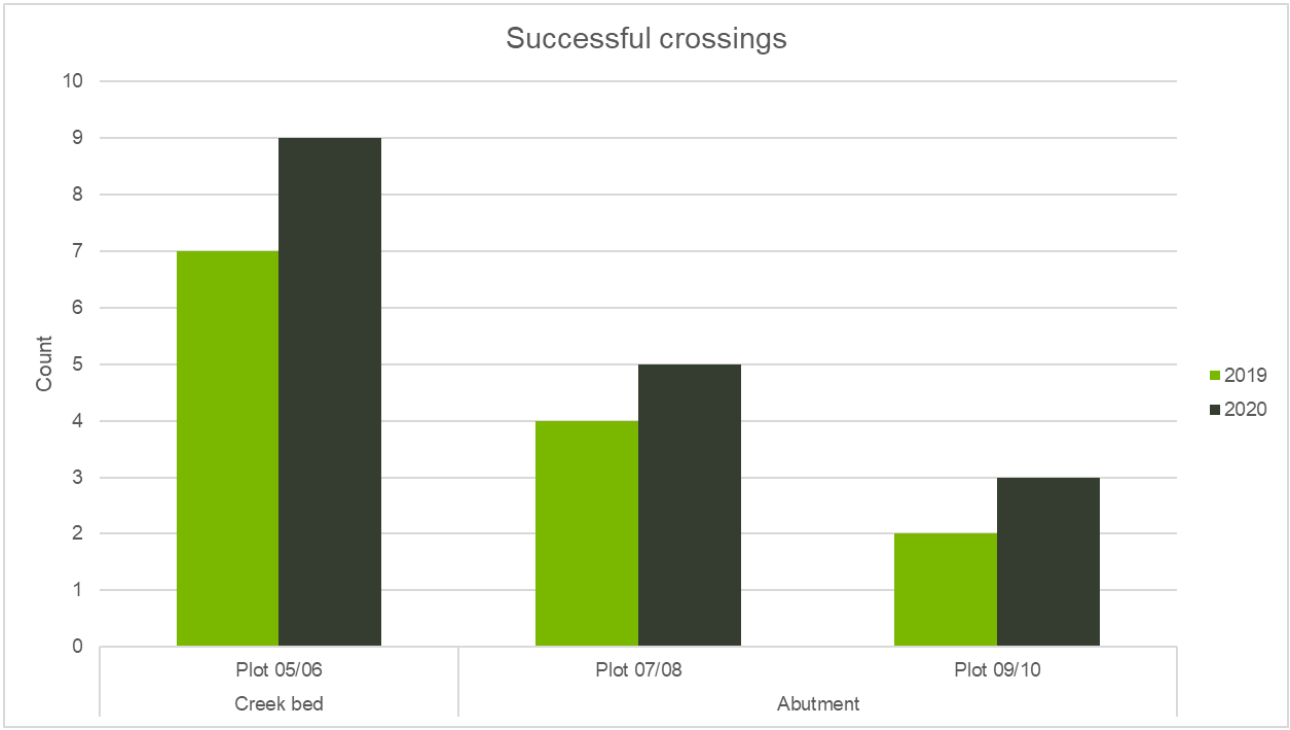

Figure 31: Comparison of successful koala crossings at Denison Creek, 2019-2020

7.2.4 Temporal movement patterns

During the two-year monitoring period at Denison and Stockyard Creek the camera traps recorded the date and times at which fauna triggered the cameras. Figure 32 shows the times, sorted chronologically, at which each of the 51 koala records were taken with the motion sensor cameras. Koalas were recorded predominantly between 7 pm and 4 am, with a single recording at 8.15 am (see Appendix B, Camera AUR07, 20200909).

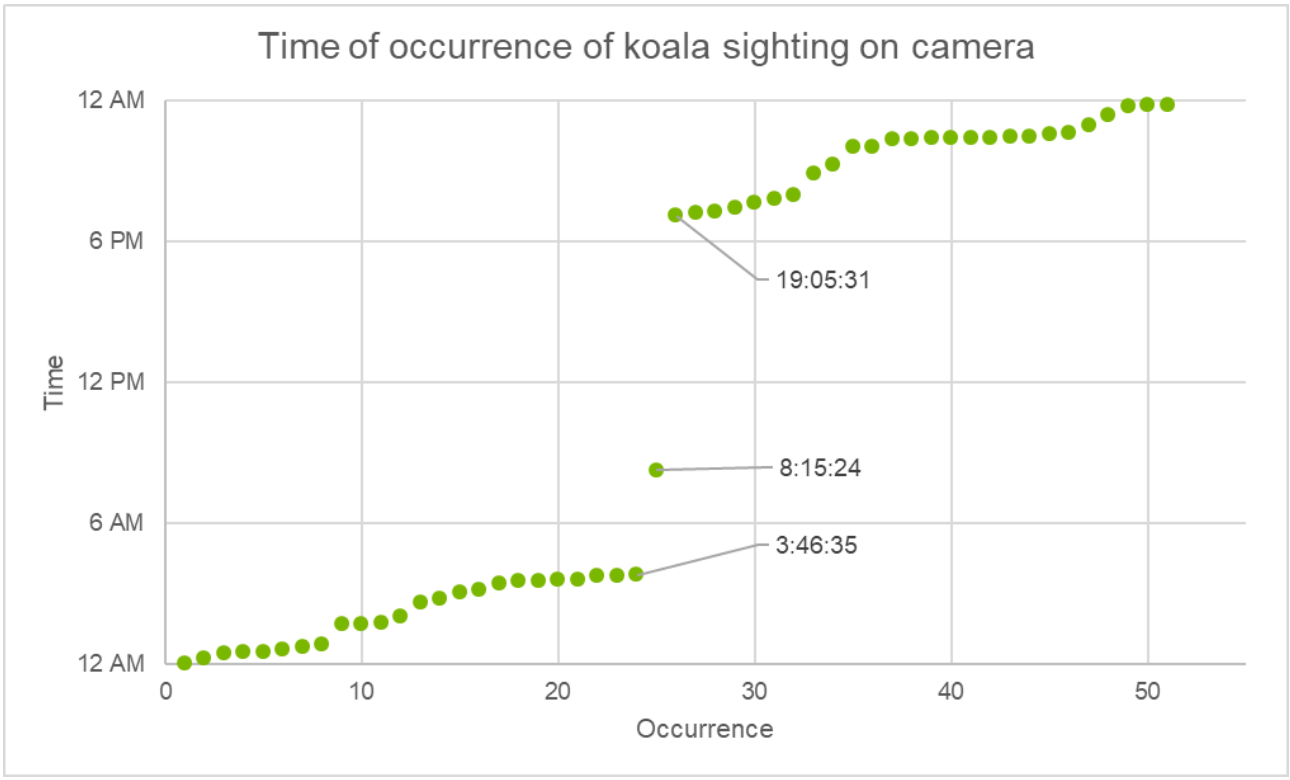

Figure 32: Temporal movement of koalas on camera

Of the 51 recordings there were 13 taken over plots at the fence lines, eight within the creek beds, six at the bridge abutments, and 24 within the road corridor. There were several occasions (see also Section 5.1.2) where the same koala was seen travelling back and forth along the fence line (see Appendix B, Camera IRC04, 20200927 and 2020/10/01).

7.3 Other species

A comprehensive list of all species recorded at Denison Creek and Stockyard Creek is provided in Appendix C. For the following analyses any counts of koalas, beetles, insects, and bats have been excluded.

A total of 12 taxa have been recorded via tracks in the Denison Creek sand plots and 11 taxa have been recorded via tracks in the Stockyard Creek sand plots (Figure 33).

At Denison Creek cattle were the only taxa that were recorded in 2019, but not in 2020. This was due to the installation of cattle exclusion fencing from the start of the 2020 monitoring season. At Stockyard Creek no dogs were recorded. The remaining 11 taxa were the same as at Denison Creek.

There were no significant differences between the number of species recorded at Denison Creek in 2019 and 2020 (two-sample t-test: $p = 0.14$). Neither was there a significant difference between the number of species recorded at Denison Creek and Stockyard Creek in 2020 (two-sample t-test: $p = 0.39$).

There was, however, a significant difference (two-sample t-test: $p < 0.05$) between the number of species recorded along the fence line (Plots 1 – 4) and in the creek bed (Plots 5 – 10) at Denison Creek (Figure 34). Although there is a difference between the number of species' tracks recorded at Stockyard (Figure 35) this was not significant (two-sample t-test: $p = 0.07$).

The location with the largest number of individual tracks recorded (noting that only one set of tracks was reported per sand plot, per species (other than koalas, which are not covered in this section)) was Denison Creek, in 2020 (283 tracks). There were 247 species' tracks recorded at Denison Creek in 2019. At Stockyard Creek 133 species' tracks were recorded.

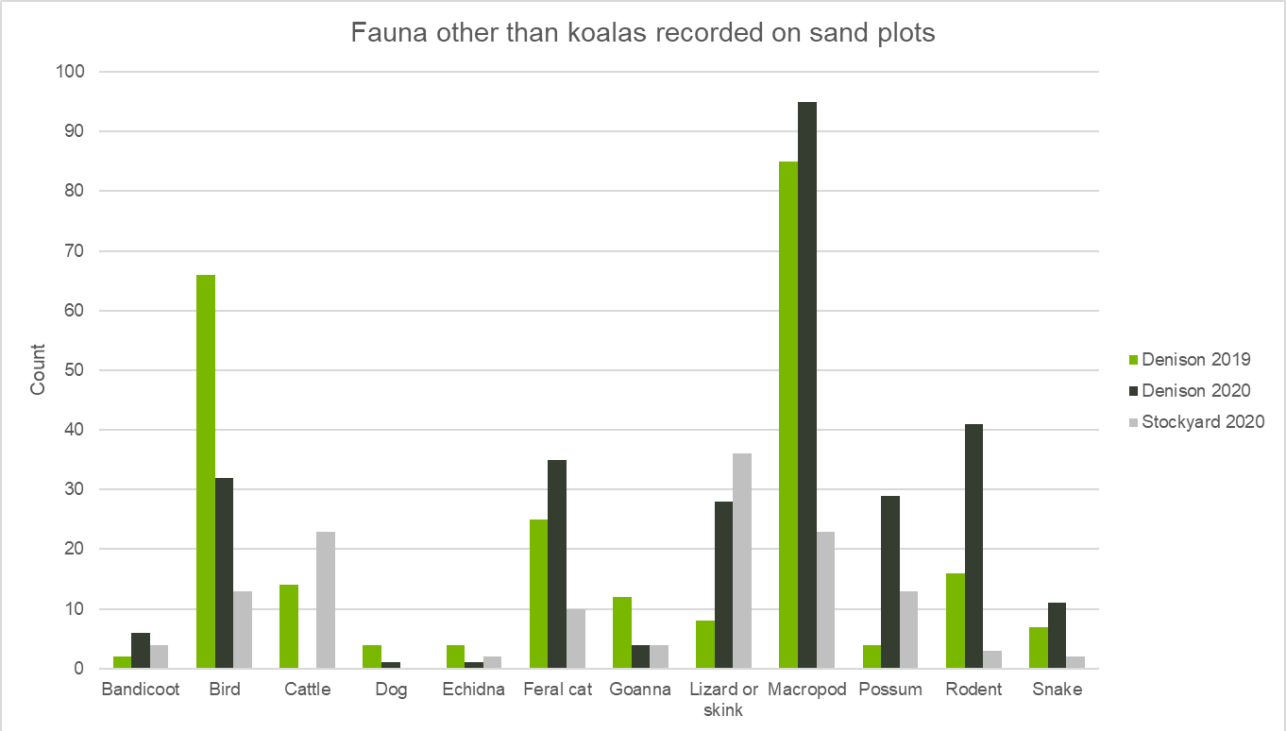

Figure 33: Species tracks recorded at Denison Creek and Stockyard Creek

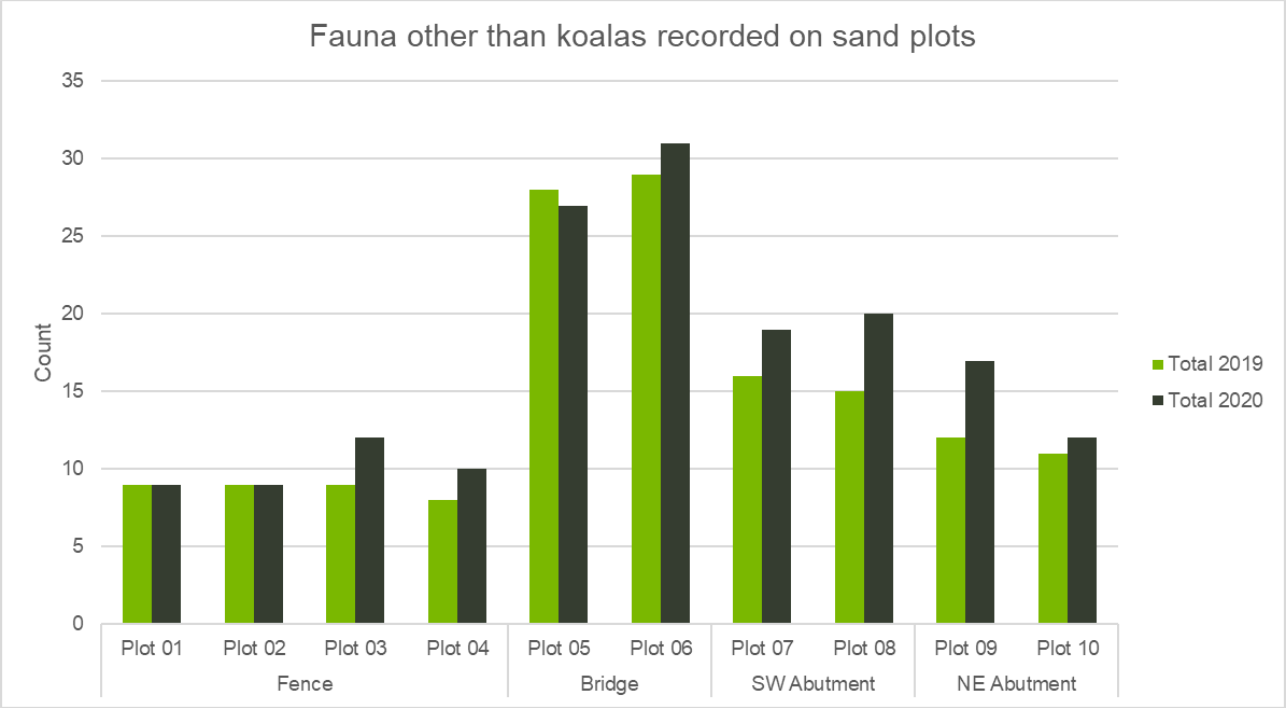

Figure 34: Total species tracks on sand plots at Denison Creek, 2019 and 2020

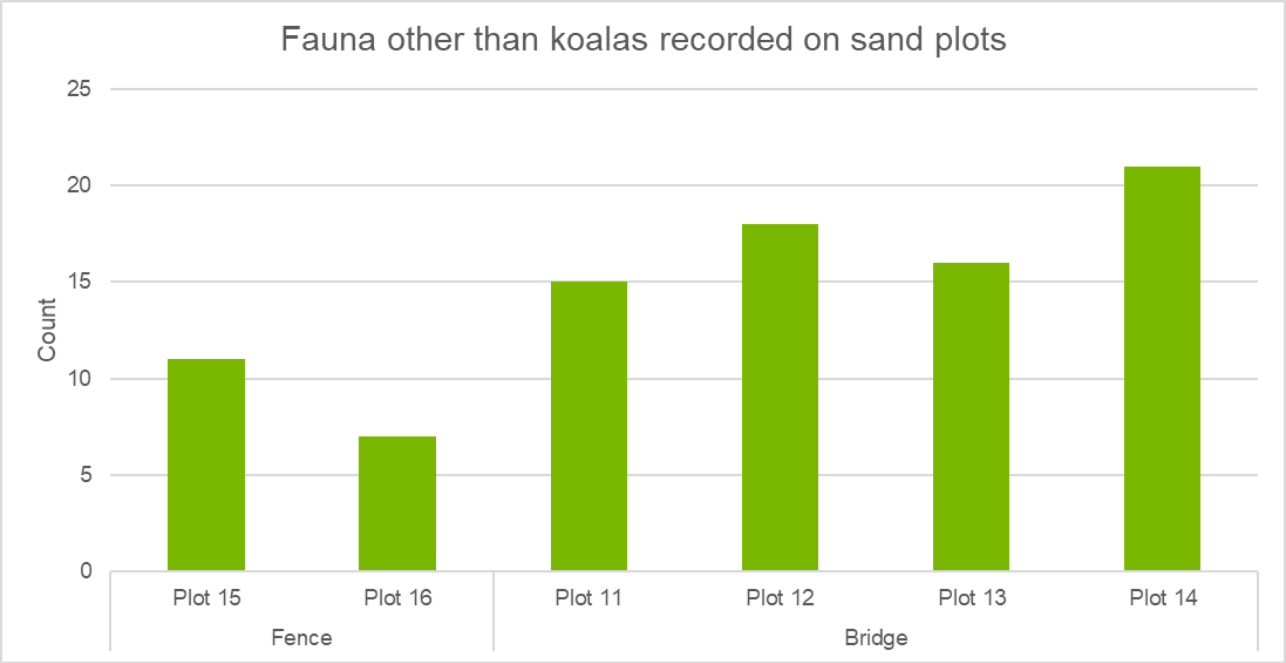

Figure 35: Total species tracks on sand plots at Stockyard Creek, 2020

The largest group of species recorded were the macropods (at 31% of all tracks from 203 counts over all locations and monitoring periods). There were 95 counts of macropods at Denison Creek in 2020 (making up 34% of all tracks), and 85 counts in 2019 (34%), while there were only 23 counts of macropod tracks (17%) at Stockyard Creek. The largest group of species' tracks recorded at Stockyard Creek were lizards/skinks (27%). Camera footage confirmed that the single most abundant species creating these tracks were water dragons. They traversed the plots in the creek bed, and at times were seen sunbathing on the sand plots (see example in Appendix B, Cameras, AUR04, 20200914).

Within the creek beds at both Denison and Stockyard Creek all twelve species (other than koalas) were recorded. On average, the most frequently recorded species were macropods and birds at Denison Creek, with tracks recorded each week (Figure 36). Similarly, at Stockyard Creek tracks of cattle and lizards (or skinks) were recorded each week. Feral cats were recorded almost weekly at Denison Creek in both 2019 and 2020, however, their tracks were observed less frequently at Stockyard Creek.

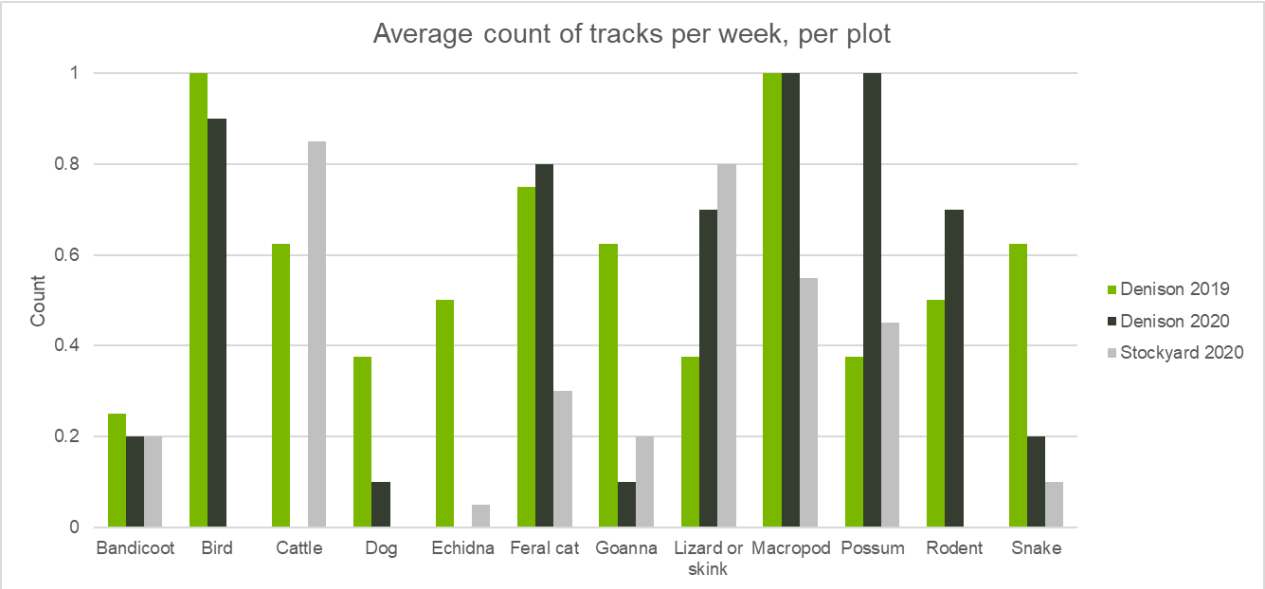

Figure 36: Average count of tracks per species per week per plot in the creek beds at Denison (Plots 5 and 6) and Stockyard Creek (Plots 11-14)

7.4 Incidental Sightings and Roadkill

7.4.1 Live koalas

Nine records of live koalas at Denison Creek were collected in 2019. In 2020, there were four sightings of live koalas at Denison Creek, and 18 at Stockyard Creek (and an additional four outside of the monitoring project boundaries, between Denison and Stockyard Creek).

Of the 18 recorded live koalas at Stockyard Creek, seven recordings were made of (what was likely to be) the same adult female and joey who preferred to be in the *E. crebra* trees in the road corridor at the gate to the property. Consequently, this data has been edited for analyses to prevent skewing, taking the total number of recordings to 12 (where the adult and joey were counted as one koala, given the dependence of the joey for survival). Between the two years, 24 live koalas were recorded at Denison Creek, Stockyard Creek, and along the Peak Downs Highway.

A total of eight koalas were recorded inside the fauna exclusion fencing (on the property side), six at Denison, two at Stockyard, making up 33% of the recordings. The remaining koalas were recorded either in the road corridor (11) or outside of the monitoring project extent (five). There was no significant difference between the number of recordings at the properties, and the road corridor over the two years (two-sample t-test: $p = 0.81$).

Most koalas (13 individuals, 54%) were seen in ironbark (*E. crebra*). Four koalas (17%) were recorded in Moreton Bay ash (*C. tessellaris*), and three (12%) in blue gum (*E. tereticornis*). The remaining four trees were not identified.

At Stockyard Creek, most recordings were made near the end of the fauna exclusion fencing at the gates to the properties, noting that this includes several sightings of the same adult female and joey. While this skewed the data, the landholder reported regularly seeing koalas in the ironbark trees near the gate (Property Owner, pers. comm). Additionally, as fencing was only installed at the southern approach to Stockyard Creek Bridge, the Aurecon team did not inspect the vegetation on the northern approach of Stockyard Creek.

7.4.2 Roadkill

A total of 26 koala roadkill have been recorded from July 2019 through to the end of the monitoring project (2 October 2020). These include seven recordings prior to the start of the 2019 monitoring period, three recordings during the 2019 monitoring period, eight between the 2019 and 2020 monitoring periods (of which three were outside of either breeding season), and eight recordings during the 2020 monitoring period. The locations of the roadkill are presented in Figure 10 and Figure 18, for 2019 and 2020, respectively.

For the purpose of these analyses the koala roadkill data have been split in three groups; Denison, Stockyard, and between bridges (see Figure 37). There was no significant difference between the number of roadkill at Denison and Stockyard (two-sample t-test: $p = 0.32$). Although more roadkill recordings were made in the 2020 monitoring period, compared to 2019, this was not statistically significant (two-sample t-test: $p = 0.27$). Similarly, while there were 10 roadkill recorded during the 2020 breeding season, compared to nine during the 2019 breeding season, this difference was not significant (two-sample t-test: $p = 0.15$). There was, however, a significant difference (two-sample t-test: $p < 0.05$) between the number of roadkill recorded prior to (seven roadkill), and during (19 roadkill) the breeding seasons over 32 and 31 weeks, respectively, for which data was available, at a mean of 0.12 and 0.61 roadkill recorded per week, respectively, prior to and during the breeding seasons. This result is not unexpected, given the increase in koala activity and movement during the breeding season (Ellis et al, 2018 and references therein).

The number of road-killed koalas at Stockyard Creek in the five-week 2020 monitoring period (five animals, including three recorded north of the site) was considerably higher, on average, than the number of BioCollect roadkill records for that location in the preceding 18 months (seven animals) (refer Figure 37). This is unlikely to reflect a genuine increase in the koala mortality rate, as the 2020 monitoring period involved intensive, targeted surveillance, whilst the previous records (pre-fence installation) were collected opportunistically. However, there were no road kills at all at Denison Creek during the 2020 monitoring

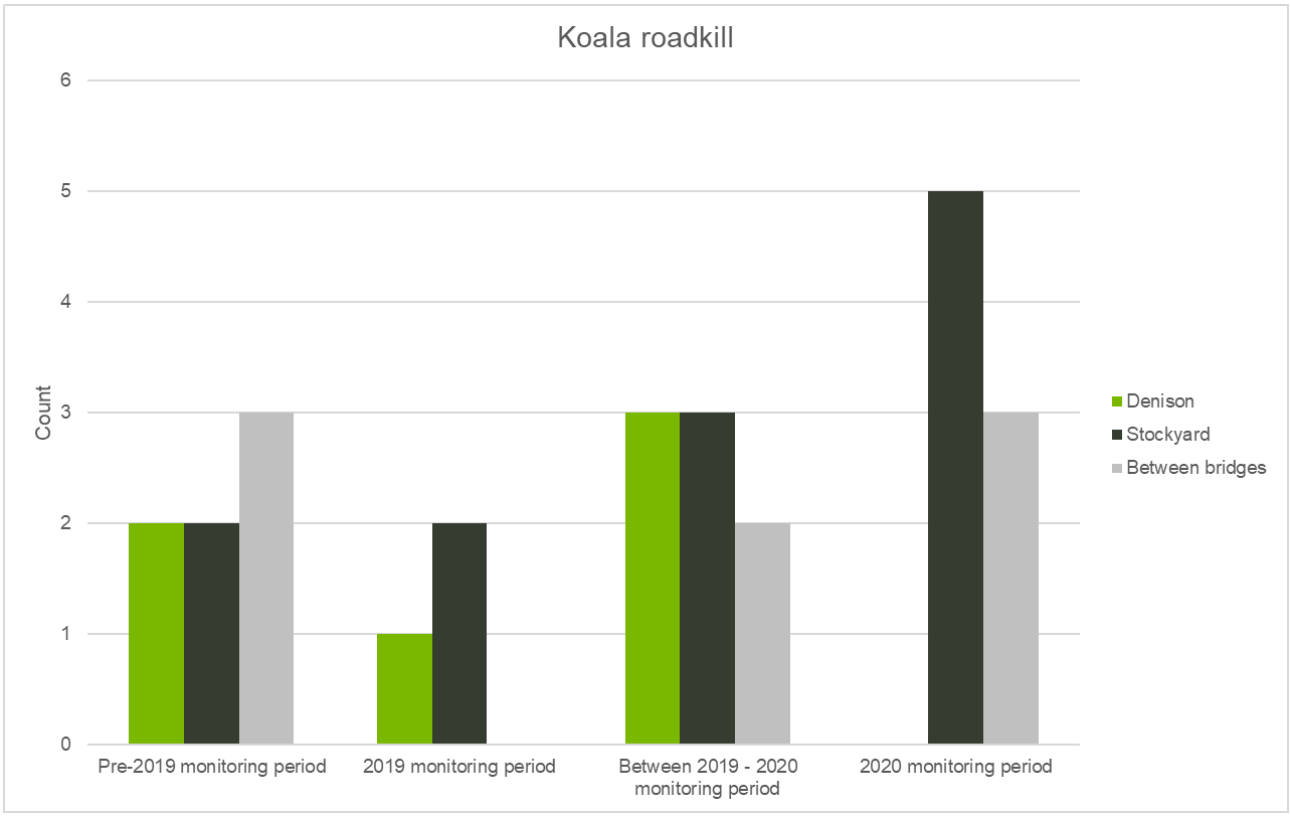

Figure 37: Koala roadkill records (from July 2019 to October 2020)

period, which has exclusion fencing funnelling wildlife to the creek on both the southern and northern approaches. At Stockyard Creek, only the northern approach is fenced.

The installation of the fauna exclusion fencing has not eliminated roadkill from either Denison Creek or Stockyard Creek, with both locations recording roadkill at the bridges since fencing has been installed. The installation of fencing at Stockyard Creek was completed in the winter of 2020.

8 Discussion

8.1 General

8.1.1 Overview

During the 2019 breeding season monitoring period, it was found that the methodology was suitable for the intended objectives of the monitoring project, with some minor adjustments (discussed below in recommendations). These adjustments were implemented for the 2020 monitoring period where possible.

The sand plots provided positive identification of tracks from animals (koalas and other species) utilising the creek beds at Denison and Stockyard Creek as a crossing location. The camera traps provided further confirmation of fauna crossings, and identified fauna travelling along the fauna exclusion fencing within the road corridor. Additionally, the camera footage confirmed that the koala's temporal movements were nocturnal, except for one koala which was seen crossing at 8 am (see Appendix B, Camera AUR07, 20200909).

Incidental sightings and roadkill records assisted in interpreting whether the fencing has provided a conservation gain for the koala, over the two-year monitoring period (2019-2020).

8.1.2 Monitoring

Funnelling and crossings

During the 2019 monitoring period, 13 successful koala crossings under Denison Creek Bridge, and one successful funnelling along the fence line in the direction of the creek (Plot 3) were recorded. When extrapolating the data over the entire breeding season, this results in approximately 85 successful crossings and seven successful funnels.

The results for the 2020 monitoring period included 17 successful koala crossings under Denison Creek Bridge, and five records of successful funnelling along the fence line in the direction of the creek (Plots 1, 3 and 4) through sand plot and camera footage, as well as two successful funnels at Stockyard Creek. As per the extrapolation methods for 2019, this results in approximately 89 successful crossings and 21 successful funnels over the entire breeding season at Denison Creek, and 11 successful funnels at Stockyard Creek for 2020. Additionally, camera footage also recorded koalas travelling in the road corridor along the fauna exclusion fencing.

As described in Section 3.5.3, there are limitations with analysing data for determining successful crossings. To ensure that there were no false positives recorded for successful crossings, the Aurecon team determined in the field if a crossing was considered successful. Camera footage aided in this determination where tracks were unclear. This was particularly useful where plots had been damaged (by rain or cattle, for example). Similarly, there were occasions where multiple koala tracks were recorded on a plot, going in opposite directions. The camera footage assisted to identify which tracks were made first and allowed for determinations of successful funnelling along the fence line.

There was an increase in crossings and successful crossings recorded under Denison Creek bridge from the 2019 to 2020 monitoring period. While this may indicate that more koalas are utilising the creek bed since the start of the installation of the fauna exclusion fencing, additional years of data (from equal monitoring lengths) would be required to indicate any clear trends. Additionally, there was no recorded reduction in the number of koala roadkill between the two years at, or surrounding, Denison Creek to indicate that the koalas are not crossing over the Peak Downs Highway. A significant difference was found, however, between the roadkill during and outside of the koala breeding season.

Camera disturbance to koala behaviour

Over the two monitoring periods there were seven occurrences where a koala was recorded sitting down in front of the camera and then either continuing its crossing or turning around. Each of these were captured by white flash Reconyx Ultrafire cameras (see example at Stockyard in Appendix B: Cameras, AUR03, 20200914, or Denison, Cameras AUR10 20200911). This could indicate that the visible camera flash disturbed the koala sufficiently for it to abandon the crossing. However, there have also been several other videos and photographs captured of active koalas from the same camera, on a later date, which indicated no perturbation from the white flash (see Appendix B Cameras, AUR10, 20200921), possibly suggesting habituation to the flash. While the size and appearance of the koalas captured on camera AUR10 are similar, there is no absolute certainty this is the same animal observed on different days.

Confirmation of these theories could be made with subsequent monitoring using sand plots, cameras, and a satellite-collar tracking study (see Section 8.5), which would identify the behaviour and movements of individual animals.

Road corridor observations

Koalas have been recorded travelling outside of the exclusion fencing (in the road corridor). Half of these records show koalas travelling toward the end of the exclusion fencing, which indicates that the koalas were trying to get to the other side of the fence and indicates that they might be able to cross into the exclusion zone safely.

While no koala roadkill were recorded at the bridges during the monitoring period, several koalas were recorded travelling toward the bridge, on the ‘road’ side of the fence. This is not an encouraging indication as there are no alternative options for koalas to get through the fauna exclusion fencing from the road corridor besides climbing over the floppy-top fencing. The absence of tracks and photo or video footage at Plot 2, which was on the opposite side of the road to Plot 1 (as covered in Section 5.1.2, see also Figure 4), suggests that the animal(s) did not cross the road, but traversed back and forth along the fence, seeking access to Denison Creek. See Section 8.5 on recommendations to better confirm koala movements.

In addition to koalas, macropods were also sighted within the road corridor.

Temporal movement patterns

Koalas were observed on camera between 7 pm and 4 am, with one exception at 8.15 am (see Section 7.2.4). This is in line with the expected temporal movement of koalas, where they are more active at night (see Ellis et al 2018).

Between July and September in 2019, an average nightly traffic volume (7 pm-5 am) at Cut Creek (further north toward Nebo along the Peak Downs Highway) of over 1 vehicle per minute (69.78 cars/hour) was recorded (T. Dalton, pers. comm.).

This demonstrates the intensity of use along the Peak Downs Highway during periods of high koala movement (in the koala breeding season), as well as highlighting the need for koala sensitive infrastructure along this road.

8.1.3 Incidental sightings

Live koalas

There was one live koala recorded in the road corridor within the fauna exclusion fencing extent during the 2019 monitoring period. Thus, while the fencing limits the ability of fauna to easily cross over the Peak Downs Highway where the fence exists, it was observed that koalas are still able to enter the road corridor at the ends of the fauna exclusion fencing, where suitable habitat occurs.

Similar to the 2019 monitoring results, the 2020 monitoring period recorded several live koalas, as well as roadkill. Live koalas were recorded both within the fauna exclusion fencing (at both Denison and Stockyard Creek) as well as in the road corridor. At Denison Creek most koalas were seen within the fauna exclusion

fencing (on the property sides), and one was recorded outside of the fauna exclusion fencing boundary. At Stockyard Creek most koala recordings were made within the road corridor, however, as highlighted in Section 5.3.2 these sightings include multiple sightings of an adult female and juvenile koala who were often seen in one of the three large ironbark (*E. crebra*) trees at the entry gate to the fenced area at Stockyard Creek.

Discussions with the landowners at Stockyard Creek on the first day of monitoring in 2020 highlighted that the ironbark trees at the entry gate to the fenced area at Stockyard Creek are known to be favoured by koalas. Ideally the fauna exclusion fencing would be installed nearer to the road to include these trees in the fenced areas. This would likely provide additional safety to the koalas utilising these trees. However, it is acknowledged that the fencing has been installed at the current location to ensure safety for road users and to allow for the required space for road maintenance, and koalas would likely walk around the fence to access these trees if fencing were altered. Without extending the exclusion fencing indefinitely or tying the fencing into a landscaping feature that is not koala transversal (ie steep cut), there are very limited ways to stop the koalas from getting in the road corridor.

Roadkill

One roadkill was recorded by DTMR within the fauna exclusion fencing extent at Denison Creek just prior to the 2019 monitoring period commencing (see Figure 10). This observation was located near a gap in the floppy top fencing at a gate access point. This gap was fixed by DTMR immediately prior to monitoring commencing, with an extension of the floppy top fencing being installed across the gate tie-ins.

Roadkill were recorded at a range of locations along the Peak Downs Highway. While the number of roadkill recordings were higher in areas where there is no fauna exclusion fencing installed, this is of itself not an indication of the effectiveness of the fauna exclusion fencing. Koala roadkill was still recorded at both Denison and Stockyard Creek where the exclusion fencing is installed, however, there is no indication that roadkill is increased at the ends of the fauna exclusion fencing.

There appeared to be a ‘hotspot’ for roadkill, approximately 3 km north of Stockyard Creek, with 3 records having been made close together during the 2020 monitoring period. The only seemingly obvious reason for there being a hotspot here, is that the location is near the intersection with an unnamed road.

8.2 Koala health

The koalas recorded in the photos and videos in 2019 and 2020, at both Denison and Stockyard Creek did not show any obvious signs of ear tags from the previous research project (as reported in Ellis et al, 2018), nor was there any evidence of disease or injury to koalas recorded on cameras. Likewise, incidental sightings of live koalas indicated the animals were in good health.

8.3 Effectiveness of fauna exclusion fencing

The effectiveness of the fauna exclusion fencing at Denison and Stockyard Creek is positive in preventing or reducing koala road deaths along the crossing area. While the installation of the fencing has not eliminated koala roadkill at either location, nor has it provided evidence that suggest koalas utilise the creek bed specifically to avoid traffic, the monitoring program has demonstrated that koalas regularly utilise the areas within the creek beds to cross the highway. There was no evidence of animals climbing over the floppy top fencing.

Recordings of koalas along the fence lines also indicated that the fencing is predominantly successful in funnelling koalas toward the creek (64% of recordings were considered successful funnels). Koalas have also been recorded (via camera footage) to be travelling along the exclusion fencing in the road corridor, without corresponding roadkill records. This may suggest that where a koala finds itself on the ‘road’ side of the fence, it may naturally travel the length of the fence until it successfully reaches the habitat it is seeking on the other side of the fence, without entering the road. This could be confirmed via a satellite collar study, combined with additional cameras deployed at the ends of the exclusion fencing. Additional features (such

as climbing poles) could be installed at the bridges where the exclusion fencing ends, which would allow koalas trapped in the road corridor to exit to habitat (see DES 2020).

Overall, the results suggest that the fauna exclusion fencing is assisting in providing safe passage under the Peak Downs Highway for koala and indicates that a conservation gain may occur for the species on the Eton Range. The results from the installation of the fauna exclusion infrastructure indicates this might improve the viability of the population. While it does not provide an immediate solution to eliminating koala deaths, it provides an important element to management of koala populations. Other elements required are, for example, habitat protection, wild dog management, community awareness, and support of wildlife carers.

8.4 Limitations

The following limitations were identified during the monitoring program:

- Scheduling of works by DTMR did not allow for sufficient time for the proposed five weeks of monitoring for 2019, prior to the Christmas/New Year's period. This was noted for the next monitoring period, and the full five weeks of monitoring were completed for 2020.
- While every effort was made to successfully identify all tracks within the sand plots, natural environmental conditions occasionally impacted the ability to confirm species tracks during the monitoring. These factors included: leaf litter and other debris, heat drying out sand, wind moving debris and dry sand across plots, insect interference, and rain (see next point).
- The sand plots were affected by rain on 16 and 18 December 2019 resulting in destruction of tracks (Week 4). Similarly, during the 2020 monitoring period, plots were affected by rain on 4, 14, 16, 18 and 25 September. Heavy rain on 25 September washed away the majority of three of the four plots under Stockyard Creek. These were re-installed on 28 September by the Aurecon team.
- Cattle movement across sand plots damaged tracks (Week 2 of the 2019 monitoring period at Denison Creek), which was addressed with the installation of temporary fencing. While this fencing was again used for the 2020 monitoring period at both Stockyard and Denison Creek, some damage due to cattle was still recorded as Stockyard Creek.
- The plots under both Denison and Stockyard Creek (Denison in particular) were impacted by runoff from the drainage holes in the bridges. This caused damage to the plots and made identification of tracks impossible at times.
- As mentioned above, while 10 potential successful crossings have been recorded in 2019, there is a chance that the two sets of tracks over two plots do not belong to the one animal, unless both were recorded on cameras, and/or tracks were clear enough to take measurements.

8.5 Recommendations

Based on the above methodology and results, the following recommendations are made regarding upcoming fauna exclusion fencing design at Denison Creek and other locations on the Peak Downs Highway:

- Continue installation of fauna exclusion fencing at the southern approach to Stockyard Creek Bridge.
- Install returns at both northern and southern ends of the fencing at Denison Creek Bridge, to improve funnelling and reduce the chance of koalas entering inside the road corridor.
- Install additional features, such as escape poles, at the bridges which can allow koalas trapped in the road corridor to exit to adjacent habitat.
- Consider fauna sensitive design during future projects along the Peak Downs Highway where the koala population is known to occur.
- Implement fauna exclusion fencing at other high-intensity wildlife crossings (eg Boundary Creek or Mount Spencer) and design fencing to continue through to property access and/or gates where possible. Improve tie in from floppy top fencing to gates (reducing gate access as much as possible), to minimise gaps in fauna exclusion fencing, and install returns at fencing where practical.

- Liaise with local landholders wherever possible during the design phase, to identify any trees known to be favoured by koala, so they can be included within the exclusion fencing.

If monitoring for fauna crossings at Denison Creek, Stockyard Creek, or other locations, Aurecon makes the following recommendations to eliminate issues as described in the Limitations Section, above:

- Commence monitoring early in breeding season, to avoid warmer temperatures, sand drying out in hot temperatures, and higher likelihood of rain damaging sand plots (ie August/September).
- Re-install temporary barbed wire fencing to keep cattle from damaging sand plots. The cattle exclusion fencing was shown to have worked at Denison Creek as there were no records of cattle on the plots. Camera footage showed that cattle were present on the property but did not attempt to cross through the creek bed.
- Ensure the cattle exclusion fencing is installed a sufficient distance from the plots and of appropriate strength to prevent cattle from either reaching in or breaking through the fence and disturbing the plots, On one occasion, cattle watched the plots being attended to, and later broke through the fence to investigate.
- Use bricklayer's loam for the sand plot installations. This consists of finer material for water holding capability, ensuring clearer tracks.
- Install plots so that they are not in line with the edge of the bridge – this would eliminate water coming off the bridge and impacting the plot.
- Install cameras at each plot, ensuring they cannot be moved and/or tampered with by cattle and other fauna. Thus, install on a star picket that is placed within the barbed wire surrounding the plot.
- Install cameras at each end of the exclusion fencing, to identify whether koalas are successfully traversing around the ends (and utilising this as a strategy to reach the creek when caught on the 'road' side of the fence).
- If possible, combine future sand and camera plot monitoring with a satellite-collar tracking study, so that movements of individual animals can be observed. Alternatively, installation of (remote access) motion sensor cameras at high-intensity wildlife crossings could provide a more cost-effective methodology for monitoring fauna movement at these crossings.
- Ensure that fencing and the fence lines are being maintained regularly.

These recommendations and subsequent monitoring events could be considered in a DTMR Strategic Plan for the local koala population, in collaboration with koala researchers and local fauna rescue groups.

9 Conclusion

The monitoring project identified that the sand plots are useful to confirm that koalas utilise Denison and Stockyard Creek as a safe crossing location. The change of consistency in the sand in 2020 provided clearer results from the tracks. The camera traps added further confirmation of crossings and funnelling, and aided in species identification, especially where sand plots had been damaged (eg due to rainfall). Camera traps were most successful where fauna crossed in confined spaces (ie along the fence line, or at the bridge abutments). Limitations with the monitoring results were predominantly related to cattle on the property and weather.

Live koalas as well as roadkill were recorded during the duration of the monitoring project. Recordings of roadkill were made at the ends of the fauna exclusion fencing, between Denison and Stockyard Creek, and outside of the project extent. Live koalas were recorded inside the exclusion fencing (property side), within the road corridor as well as outside of the exclusion fencing extent.

Both successful crossings and funnels were recorded. While there were more successful crossings and funnels, than undetermined crossings and unsuccessful funnels, there were no statistically significant differences found between sites or years. Koalas were also recorded travelling in the road corridor, along the fence line. Most of these observations showed koalas travelling away from the bridges, toward the end of the fauna exclusion fencing.

Koalas were observed on camera between 7 pm and 4 am, with one exception at 8.15 am. Having an average nightly traffic volume of one vehicle per minute along the Peak Downs Highway shows the importance of koala sensitive infrastructure along this road.

The fauna exclusion fencing is assisting in providing safe passage under the Peak Downs Highway for koala and indicates that a conservation gain may occur for the species on the Eton Range. The installation of additional fauna exclusion fencing along the Peak Downs Highway would likely significantly increase the effectiveness in providing a benefit for the wider population in the Clarke-Connors Range.

Appendix A
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Appendix B
Photo report

Cameras

AUR01

20200831

Cow

AUR01

20200902

Macropod

Cameras

AUR01

20200904

Cow

AUR01

20200909

Macropod

Cameras

AUR01

20200911

Feral cat

AUR01

20200911

Squatter pigeon

Cameras

AUR01

20200914

Feral cat

AUR01

20200916

Feral cat

Cameras

AUR01

20200916

Echidna

AUR01

20200918

Willie wagtail

Cameras

AUR01

20200921

Macropod

AUR01

20200928

Macropod

Cameras

AUR01

20200930

Koala

AUR01

20200930

Koala

Cameras

AUR01

20200930

Koala

AUR01

20200930

Australian magpie

Cameras

AUR01

20201002

Koala

AUR01

20201002

Koala

Cameras

AUR01

20201002

Koala

AUR01

20201002

Australian magpie

Cameras

AUR02

20191127

Cow

AUR02

20191129

Feral cat

Cameras

AUR02

20191204

Torresian Crow

AUR02

20191216

Macropod

Cameras

AUR02

20191216

Feral cat

AUR02

20200831

Cow

Cameras

AUR02

20200831

Goanna

AUR02

20200831

Common brushtail possum

Cameras

AUR02

20200831

Echidna

AUR02

20200904

Cow

Cameras

AUR02

20200904

Cow

AUR02

20200907

Water dragon

Cameras

AUR02

20200909

Common brushtail possum

AUR02

20200911

Goanna

Cameras

AUR02

20200911

Bandicoot - Unsure about species due to photo angle

AUR02

20200911

Common brushtail possum

Cameras

AUR02

20200914

Water dragon

AUR02

20200914

Feral cat

Cameras

AUR02

20200914

Cow

AUR02

20200916

Bandicoot - Unsure about species due to photo angle

Cameras

AUR02

20200918

Northern brown bandicoot

AUR02

20200918

Water dragon

Cameras

AUR02

20200918

Gonna

AUR02

20200921

Macropod

Cameras

AUR02

20200923

Goanna

AUR02

20200923

Cow

Cameras

AUR02

20201002

Common brushtail possum

AUR03

20191127

Cow

Cameras

AUR03

20191129

Koala

AUR03

20191129

Koala

Cameras

AUR03

20191129

Koala

AUR03

20191129

Koala

Cameras

AUR03

20191129

Koala

AUR03

20191129

Koala

Cameras

AUR03

20191211

Macropod

AUR03

20191211

Macropod

Cameras

AUR03

20191211

Macropod

AUR03

20191216

Macropod

Cameras

AUR03

20191216

Macropod

AUR03

20191216

Australian magpie

Cameras

AUR03

20200831

Water dragon

AUR03

20200831

Water dragon

Cameras

AUR03

20200831

Echidna

AUR03

20200831

Bandicoot - most likely long-nosed bandicoot due to length of ears, uncertain due to movement in p

Cameras

AUR03

20200831

Water dragon

AUR03

20200904

Macropod

Cameras

AUR03

20200904

Cow

AUR03

20200911

Goanna

Cameras

AUR03

20200911

Northern brown bandicoot

AUR03

20200914

Koala

Cameras

AUR03

20200914

Koala

AUR03

20200914

Koala

Cameras

AUR03

20200914

Water dragon

AUR03

20200914

Feral cat

Cameras

AUR03

20200916

Macropod

AUR03

20200916

Cow

Cameras

AUR03

20200918

Water dragon

AUR04

20191122

Feral cat

Cameras

AUR04

20191202

Bar-shouldered dove

AUR04

20191202

Cow

Cameras

AUR04

20191213

Feral ccat

AUR04

20191216

Macropod

Cameras

AUR04

20200831

Macropod

AUR04

20200831

Northern brown bandicoot

Cameras

AUR04

20200831

Common brushtail possum

AUR04

20200831

Cow

Cameras

AUR04

20200831

Echidna

AUR04

20200904

Macropod

Cameras

AUR04

20200909

Common brushtail possum

AUR04

20200914

Feral cat

Cameras

AUR04

20200914

Water dragon

AUR04

20200914

Cow

Cameras

AUR04

20200916

Feral cat

AUR04

20200916

Bandicoot - Most likely long-nosed bandicoot due to length of ears, uncertain due to front-on photo

Cameras

AUR04
20200916

Echidna

AUR04
20200918

Northern brown bandicoot

Cameras

AUR04

20200918

Water dragon

AUR04

20200921

Feral cat

Cameras

AUR04

20200923

Common brushtail possum

AUR04

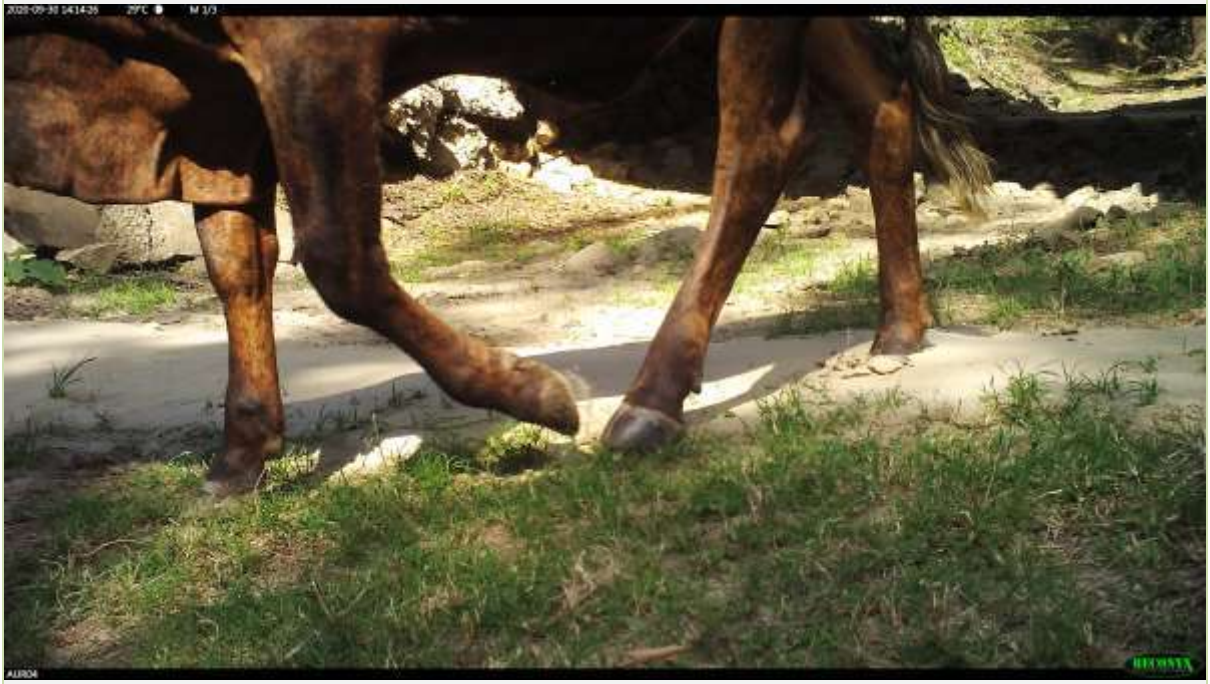
20200928

Macropod

Cameras

AUR04

20201002



Cow

AUR04

20201002

Macropod

Cameras

AUR04

20201002

Common brushtail possum

AUR05

20191127

Cow

Cameras

AUR05

20191213

Macropod

AUR05

20200831

Macropod

Cameras

AUR05

20200831

Bettong

AUR05

20200831

Feral cat

Cameras

AUR05

20200831

Feral cat

AUR05

20200831

Macropod

Cameras

AUR05
20200907

Koala - Within the road corridor

AUR05
20200907

Koala - Within the road corridor

Cameras

AUR05
20200907

Koala

AUR05
20200907

Koala

Cameras

AUR05
20200907

Koala

AUR05
20200909

Koala

Cameras

AUR05

20200909

Koala

AUR05

20200909

Koala

Cameras

AUR05
20200909

Koala

AUR05
20200909

Koala

Cameras

AUR05
20200909

Koala

AUR05
20200911

Koala

Cameras

AUR05

20200911

Koala

AUR05

20200911

Koala

Cameras

AUR05

20200914

Feral cat

AUR05

20200914

Feral cat

Cameras

AUR05

20200914

Koala - Within the road corridor

AUR05

20200914

Koala - Within the road corridor

Cameras

AUR05

20200914

Koala - Within the road corridor

AUR05

20200916

Macropod

Cameras

AUR05

20200918

Macropod

AUR05

20200921

Australian magpie

Cameras

AUR05

20200930

Feral cat

AUR06

20191125

Macropod

Cameras

AUR06

20191125

Koala

AUR06

20191125

Koala

Cameras

AUR06

20191125

Koala

AUR06

20191127

Northern brown bandicoot

Cameras

AUR06

20191127

Macropod

AUR06

20191204

Koala

Cameras

AUR06

20191206

Macropod

AUR06

20191209

Torresian crow

Cameras

AUR06

20191209

Australian magpie

AUR06

20191213

Cow

Cameras

AUR06

20191216

Koala

AUR06

20200831

Macropod (Rufous bettong)

Cameras

AUR06

20200831

Common brushtail possum

AUR06

20200831

Red bellied black snake

Cameras

AUR06

20200904

Macropod

AUR06

20200907

Common brushtail possum

Cameras

AUR06

20200914

Feral cat

AUR06

20200921

Koala

Cameras

AUR06

20200921

Koala

AUR06

20200921

Koala

Cameras

AUR06

20200921

Koala

AUR06

20200921

Koala

Cameras

AUR06

20200921

Koala

AUR07

20191122

Macropod

Cameras

AUR07

20191202

Torresian crow, Cow

AUR07

20191204

Koala

Cameras

AUR07

20191204

Koala

AUR07

20191204

Koala

Cameras

AUR07

20191204

Koala

AUR07

20191204

Koala

Cameras

AUR07

20191204

Koala

AUR07

20191204

Koala

Cameras

AUR07

20191204

Koala

AUR07

20191204

Koala

Cameras

AUR07

20191204

Koala

AUR07

20191204

Koala

Cameras

AUR07

20191204

Koala

AUR07

20191206

Macropod

Cameras

AUR07

20191206

Torresian crow

AUR07

20191206

Macropod

Cameras

AUR07

20191206

Macropod

AUR07

20191209

Koala

Cameras

AUR07

20191209

Koala

AUR07

20191209

Koala

Cameras

AUR07

20191213

Feral cat

AUR07

20200831

Cow

Cameras

AUR07
20200902

Feral cat

AUR07
20200902

Common brushtail possum

Cameras

AUR07

20200904

Feral cat

AUR07

20200907

People

Cameras

AUR07

20200909

Koala

AUR07

20200909

Koala

Cameras

AUR07

20200909

Koala

AUR07

20200923

Macropod

Cameras

AUR07

20200925

Torresian crow

AUR08

20191127

Cow

Cameras

AUR08

20191127

Northern brown bandicoot

AUR08

20191206

Torresian crow

Cameras

AUR08

20191209

Macropod

AUR08

20191211

Macropod

Cameras

AUR08

20191211

Macropod

AUR08

20191213

Macropod

Cameras

AUR08

20200831

Macropod

AUR08

20200831

Macropod

Cameras

AUR08

20200902

Macropod

AUR08

20200904

Torresian Crow

Cameras

AUR08

20200907

Macropod

AUR08

20200928

Macropod

Cameras

AUR09

20191125

Macropod

AUR09

20191125

Nankeen night heron

Cameras

AUR09

20191125

Nankeen night heron

AUR09

20191127

Cow

Cameras

AUR09

20191129

Feral cat

AUR09

20191202

Macropod

Cameras

AUR09

20191202

Goanna

AUR09

20191202

Goanna

Cameras

AUR09

20191202

Macropod

AUR09

20191204

Torresian Crow

Cameras

AUR09

20191204

Dog

AUR09

20191204

Macropod

Cameras

AUR09

20191204

Water dragon

AUR09

20191206

Macropod

Cameras

AUR09

20191209

Macropods

AUR09

20191209

Macropods (Rufous bettong)

Cameras

AUR09

20200831

Common brushtail possum

AUR09

20200831

Bandicoot - unsure of species due to movement in photo

Cameras

AUR09

20200914

Koala

AUR09

20200914

Koala

Cameras

AUR09

20200914

Koala

AUR09

20200914

Koala

Cameras

AUR09

20200914

Koala

AUR09

20200914

Koala

Cameras

AUR09

20200914

Long-nosed bandicoot

AUR09

20200916

Bandicoot - Unsure about species due to movement in photo

Cameras

AUR10

20191122

Macropod (Rufous bettong)

AUR10

20191122

Macropod (Rufous bettong)

Cameras

AUR10

20191125

Snake

AUR10

20191125

Snake

Cameras

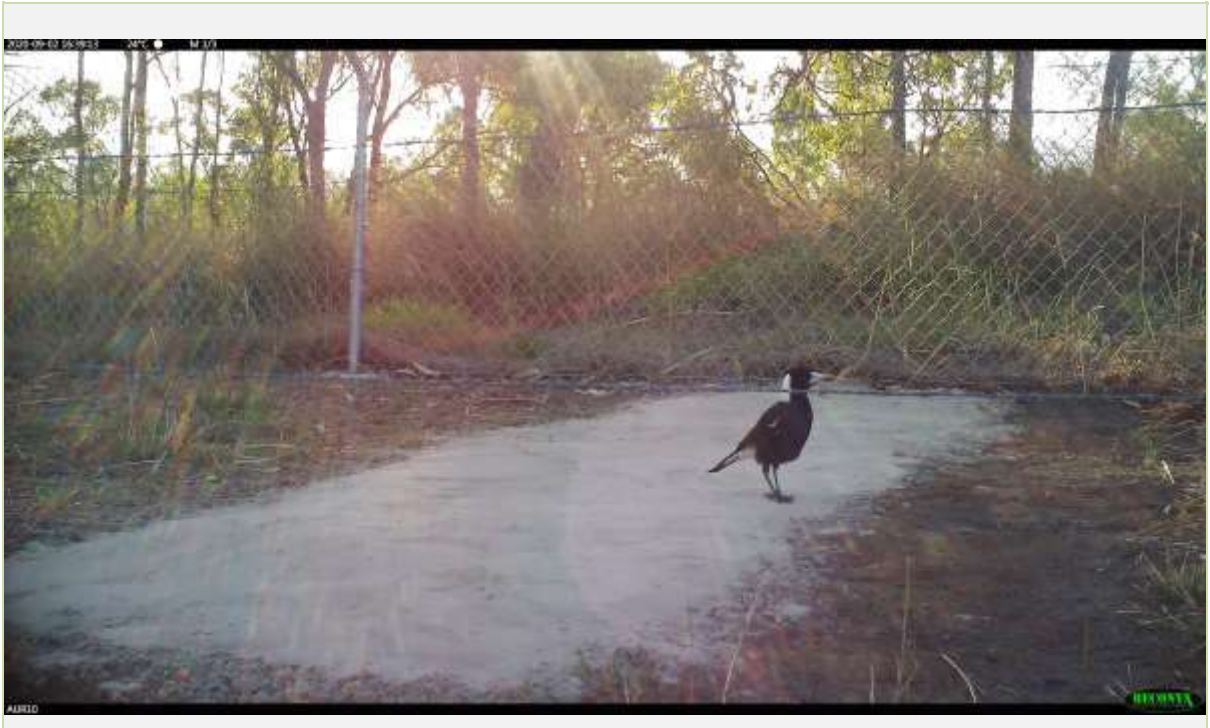
AUR10

20200902

Macropod

AUR10

20200904



Australian magpie

Cameras

AUR10

20200907

Feral cat

AUR10

20200909

Echidna

Cameras

AUR10

20200911

Feral cat

AUR10

20200911

Koala

Cameras

AUR10

20200911

Koala

AUR10

20200911

Koala

Cameras

AUR10

20200911

Koala

AUR10

20200911

Koala

Cameras

AUR10
20200911

Australian magpie

AUR10
20200911

Koala

Cameras

AUR10

20200911

Koala

AUR10

20200911

Koala

Cameras

AUR10
20200918

Echidna

AUR10
20200921

Australian magpie

Cameras

AUR10

20200921

Macropod

AUR10

20200921

Koala

Cameras

AUR10

20200921

Koala

AUR10

20200921

Koala

Cameras

AUR10
20200921

Koala

AUR10
20200921

Koala

Cameras

AUR10
20200921

Koala

AUR10
20200921

Koala

Cameras

AUR10

20200921

Koala

AUR10

20200921

Koala

Cameras

AUR10

20200923

Macropod

IRC01

20191122

Feral cat

Cameras

IRC01

20191125

Macropod (Rufous bettong)

IRC01

20191125

Macropod (Rufous bettong)

Cameras

IRC01

20191213

Macropod

IRC01

20200831

Macropod (Rufous bettong)

Cameras

IRC01

20200831

Macropod

IRC01

20200904

Koala

Cameras

IRC01

20200904

Koala

IRC01

20200907

People

Cameras

IRC01

20200909

Common brushtail possum

IRC01

20200921

Cameras

IRC01

20200921

IRC01

20200925

Feral cat

Cameras

IRC01

20200930

Macropod

IRC01

20201002

Koala

Cameras

IRC02

20191127

Cow

IRC02

20191127

Torresian crow

Cameras

IRC02

20191129

Macropod

IRC02

20191202

Feral cat

Cameras

IRC02

20191213

Macropod

IRC02

20191213

Macropod

Cameras

IRC02

20200831

Torresian crow

IRC02

20200831

Macropod (Rufous bettong)

Cameras

IRC02

20200911

Common brushtail possum

IRC02

20200914

Feral cat

Cameras

IRC02

20200921

Macropod

IRC03

20191202

Australian magpie

Cameras

IRC03

20191209

Macropod

IRC03

20191209

Macropod

Cameras

IRC03

20191211

Australian magpie

IRC03

20191216

Torresian crow

Cameras

IRC03

20200831

Common brushtail possum

IRC03

20200831

Macropod

Cameras

IRC03

20200831

Macropod

IRC03

20200831

Feral cat

Cameras

IRC03

20200902

Common brushtail possum

IRC03

20200904

Macropod (Rufous bettong)

Cameras

IRC03

20200916

Macropod

IRC03

20200918

Australian magpie

Cameras

IRC03

20200928

Common brushtail possum

IRC04

20200831

Austrlian bustard

Cameras

IRC04

20200831

Austrlian bustard

IRC04

20200831

Austrlian magpie

Cameras

IRC04

20200831

Macropod

IRC04

20200907

Straw-necked ibis

Cameras

IRC04

20200914

Macropod

IRC04

20200914

Koala - Within the road corridor

Cameras

IRC04

20200921

Galah

IRC04

20200928

People

Cameras

IRC04

20200928

Macropod

IRC04

20200928

Koala - Within the road corridor

Cameras

IRC04

20200928

Koala - Within the road corridor

IRC04

20200928

Koala - Within the road corridor

Cameras

IRC04

20200928

Koala - Within the road corridor

IRC04

20200928

Koala - Within the road corridor

Cameras

IRC04

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Koala - Within the road corridor

IRC04

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Koala - Within the road corridor

Cameras

IRC04

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Koala - Within the road corridor

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Koala - Within the road corridor

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IRC04

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Koala - Within the road corridor

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Koala - Within the road corridor

Cameras

IRC04

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Koala - Within the road corridor

IRC04

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Koala - Within the road corridor

Cameras

IRC04

20200928

Koala - Within the road corridor

IRC04

20200928

Koala - Within the road corridor

Cameras

IRC04

20200928

Koala - Within the road corridor

IRC04

20200928

Koala - Within the road corridor

Cameras

IRC04

20200928

Macropod

IRC04

20200928

Koala - Within the road corridor

Cameras

IRC04

20200928

Koala - Within the road corridor

IRC04

20200928

Koala - Within the road corridor

Cameras

IRC04

20200928

Koala - Within the road corridor

IRC04

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Koala - Within the road corridor

Cameras

IRC04

20200928

Koala - Within the road corridor

IRC04

20200928

Koala - Within the road corridor

Cameras

IRC04

20200928

Koala - Within the road corridor

IRC04

20200928

Koala - Within the road corridor

Cameras

IRC04

20200928

Koala - Within the road corridor

IRC04

20200928

Koala - Within the road corridor

Cameras

IRC04

20201002

Koala - Within the road corridor

IRC04

20201002

Koala - Within the road corridor

Cameras

IRC04

20201002

Koala - Within the road corridor

IRC04

20201002

Koala - Within the road corridor

Cameras

IRC04

20201002

Koala - Within the road corridor

IRC04

20201002

Koala - Within the road corridor

Cameras

IRC04

20201002

Koala - Within the road corridor

IRC05

20200831

Bush stone-curlew

Cameras

IRC05

20200831

Bush stone-curlew

IRC05

20200907

Peaceful dove

Cameras

IRC05

20200914

Feral cat

IRC05

20200916

Bush stone-curlew

Cameras

IRC06

20200909

Feral cat

IRC06

20200911

Water dragon

Cameras

IRC06

20200925

Common brushtail possum

IRC06

20200928

Common brushtail possum

Cameras

IRC06

20200928

Cane toad

IRC06

20200928

Cane toad

Cameras

IRC06

20201002

Water dragon

IRC06

20200831

Water dragon

Cameras

IRC09

20200904

Cow

IRC09

20200907

Water dragon

Cameras

IRC09

20200911

Goanna

IRC09

20200911

Feral cat

Cameras

IRC09

20200911

Water dragon

IRC09

20200914

Koala

Cameras

IRC09

20200923

Cow

IRC09

20200930

Common brushtail possum

Cameras

IRC09

20201002

Goanna

Cam1

20191119

Koala in tree

Incidental_Sightings

Cam1

20191120

Koala in tree

Cam1

20191122

Koala in tree

Incidental_Sightings

Cam1

20191122

Koala in tree

Cam1

20191122

Koala in tree

Incidental_Sightings

Cam1

20191125

Koala in tree

Cam1

20191206

Koala in tree

Incidental_Sightings

Cam1

20191211

Koala in tree

Cam1

20191213

Koala in tree

Incidental_Sightings

Cam1

20201006

Koalas in tree (mother and joey)

Cam1

20201006

Koalas in tree (mother and joey)

Incidental_Sightings

Cam1

20201006

Koalas in tree (mother and joey)

Cam1

20201006

Koala in tree

Incidental_Sightings

Cam1

20201006

Koalas in tree (mother and joey)

Cam1

20201006

Koala in tree

Incidental_Sightings

Cam1

20201006

Koala in tree

Cam1

20201006

Koala in tree

Incidental_Sightings

Cam1

20201006

Koala in tree

Cam1

20201006

Koalas in tree (three, including a mother and joey)

Incidental_Sightings

Cam1

20201006

Koala in tree

Cam1

20201006

Koala in tree

Incidental_Sightings

Cam1

20201006

Koala in tree

Cam1

20201006

Koala in tree

Incidental_Sightings

Cam1

20201006

Koala in tree

Cam1

20201006

Koala in tree

Incidental_Sightings

Cam1

20201006

Koala in tree

Cam1

20201006

Koalas in tree

Incidental_Sightings

Cam1

20201006

Koala in tree

Cam1

20201006

Koala in tree

Appendix C
Fauna data

Species name	Common name	Location
Camera traps		
Aepyprymnus rufescens	Rufous betting	Denison
Ardeotis australis	Australian bustard	Denison
Bos taurus	Cattle	Denison, Stockyard
Burhinus grallarius	Bush stone-curlew	Stockyard
Cacatua galerita	Cockatoo	Denison
Canis lupus familiaris	Dog	Denison
Corvus orru	Crow	Denison
Cracticus tibicen	Magpie	Denison, Stockyard
Eolophus roseicapilla	Galah	Denison
Felis catus	Feral cat	Denison, Stockyard
Geopelia placida	Peaceful dove	Stockyard
Grallina cyanoleuca	Magpie-lark	Denison
Intellagama lesueurii	Water dragon	Denison, Stockyard
Isoodon macrourus	Northern Brown bandicoot	Denison
Macropus spp	Macropods	Denison, Stockyard
Nycticorax caledonicus	Nankeen night heron	Denison
Phascolarctos cinereus	Koala	Denison, Stockyard
Pseudechis porphyriacus	Red-bellied black snake	Denison
Rhinella marina	Cane toad	Stockyard
Rhipidura leucophrys	Willie wagtail	Stockyard
Tachyglossus aculeatus	Echidna	Denison, Stockyard
Threskiornis spinicollis	Straw necked ibis	Denison
Trichosurus vulpecula	Common brushtail possum	Denison, Stockyard
Varanus varius	Monitor lizard	Denison, Stockyard
Unidentified to species level	Bat	Denison
Unidentified to species level	Rodent	Denison, Stockyard
Sand plots		
Unidentified to species level	Bandicoot	Denison, Stockyard
Unidentified to species level	Birds	Denison, Stockyard

Bos taurus	Cattle	Denison, Stockyard
Canis lupus familiaris	Dog	Denison
Tachyglossus aculeatus	Echidna	Denison, Stockyard
Felis catus	Feral cat	Denison, Stockyard
Varanus varius	Goanna	Denison, Stockyard
Unidentified to species level	Lizard or skink	Denison, Stockyard
Unidentified to species level	Macropods	Denison, Stockyard
Unidentified to species level	Possum	Denison, Stockyard
Unidentified to species level	Rodent	Denison, Stockyard
Unidentified to species level	Snake	Denison, Stockyard
Scat collection		
Bos taurus	Cow	Denison, Stockyard
Phascolarctos cinereus	Koala	Denison, Stockyard
Unidentified to species level	Bats	Denison
Roadkill		
Phascolarctos cinereus	Koala	See Appendix D

Appendix D
Roadkill data

Latitude	Longitude	Date koala sighted	Timing	Record - group
-21.41453051	148.9068996	2019-07-21	Pre-2019 monitoring period	Other
-21.48275	148.8099	2019-07-30	Pre-2019 monitoring period	Other
-21.4649861	148.8437361	2019-08-10	Pre-2019 monitoring period	Fauna Rescue Whitsundays
-21.4696399	148.8285322	2019-09-12	Pre-2019 monitoring period	Fauna Rescue Whitsundays
-21.4338802	148.8784844	2019-10-12	Pre-2019 monitoring period	Fauna Rescue Whitsundays
-21.4455	148.8673	2019-10-24	Pre-2019 monitoring period	Fauna Rescue Whitsundays
-21.47944298	148.8130445	2019-11-07	Pre-2019 monitoring period	DTMR
-21.434936	148.87734	2019-11-25	2019 monitoring period	Aurecon
-21.42354846	148.8954413	2019-11-28	2019 monitoring period	DTMR
-21.4743333	148.8177778	2019-11-29	2019 monitoring period	Aurecon
-21.4093216	148.9153184	2020-06-10	Pre-2020 monitoring period	Fauna Rescue Whitsundays
-21.47741992	148.8147784	2020-06-26	Pre-2020 monitoring period	Fauna Rescue Whitsundays
-21.4718071	148.8205567	2020-06-26	Pre-2020 monitoring period	Fauna Rescue Whitsundays
-21.43117012	148.8825211	2020-07-07	Pre-2020 monitoring period	DTMR
-21.4629436	148.8476334	2020-07-17	Pre-2020 monitoring period	DTMR
-21.42981389	148.8864023	2020-07-27	Pre-2020 monitoring period	Fauna Rescue Whitsundays
-21.56111583	148.756464	2020-08-15	Pre-2020 monitoring period	Fauna Rescue Whitsundays
-21.439196	148.873383	2020-08-22	Pre-2020 monitoring period	Fauna Rescue Whitsundays
-21.4136889	148.9074556	2020-08-24	2020 monitoring period	Aurecon
-21.4416417	148.8711556	2020-09-09	2020 monitoring period	Aurecon
-21.43397297	148.8785917	2020-09-17	2020 monitoring period	Fauna Rescue Whitsundays
-21.4177306	148.9040361	2020-09-18	2020 monitoring period	Aurecon
-21.4152056	148.9062694	2020-09-18	2020 monitoring period	Aurecon
-21.43802834	148.8744757	2020-09-27	2020 monitoring period	Fauna Rescue Whitsundays
-21.4702194	148.8262528	2020-09-28	2020 monitoring period	Aurecon
-21.47019106	148.8267419	2020-09-28	2020 monitoring period	Fauna Rescue Whitsundays

Appendix E
Camera and plot locations, Denison 2019

aurecon

Legend

- Camera Locations
- Sand Plot
- Fauna Fencing

Notes:

Date: 16/01/2020 Version: 1

Author: P:\GIS\Projects\507913_DTMR_Denison_Creek_Fauna_Monitoring\507913_Figure2.mxd 10/01/2020 09:26

A3 scale: 1:2,000

0 50 100 Metres

Job No: 507913

Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere

Denison Creek Fauna Fencing 2019 Monitoring

Figure Appendix E: Monitoring Methodology

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