

# Eton Range Realignment - Fauna Underpass Monitoring & Assessment

State Route 70, Eton QLD 4741

30 April 2021



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## State Route 70, Eton QLD 4741

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# TABLE OF CONTENTS

1	MILESTONE 1 INTERIM REPORT .....	2
1.1	INTRODUCTION AND BACKGROUND .....	2
1.2	AIMS .....	2
1.3	STUDY AREA .....	2
2	METHOD.....	4
3	RESULTS AND RECOMMENDATIONS .....	5
3.1	RESULTS .....	5
3.2	RECOMMENDATIONS.....	7
4	CONCLUSION .....	8
5	REFERENCES.....	9

## TABLES

Table 1:	Summary of Field Methods .....	4
Table 2:	Camera Trap Interactions with Culverts .....	5
Table 3:	Sand Plot Trap Interactions with Culverts .....	6

## APPENDICES

Appendix 1:	Fauna Table of Camera Interactions
Appendix 2:	Fauna Table of Sand Plot Interactions
Appendix 3:	Fauna Table of TMR Camera Traps



# 1 MILESTONE 1 INTERIM REPORT

## 1.1 Introduction and Background

The Department of Transport and Main Roads (TMR) required monitoring, analysis and reporting on the effectiveness of fauna exclusion fencing and the fauna underpasses constructed for the Eton Range Realignment Project (ERRP). The exclusion fencing was required due to historical data that indicated that a number of fauna were being struck across various chainages of the Peak Downs Highway (Melzer 2018). Among the fauna impacted includes the Koala (*Phascolarctos cinereus*) which is listed as Vulnerable in Queensland. Monitoring was required to be undertaken to comply with the ERRP Commonwealth Approval 2016/7552, Conditions 4 & 5.

A report authorised by TMR within the Peak Downs Highway (Isaac Regional Council) have used radio tracking methods to identify the typical habitat range, daily movement, *Chlamydia* burden and overall population health of Koalas within the Clarke-Connors Ranges (Ellis, W *et al.* 2018). Recent studies undertaken in the Clarke Connors Ranges describe the Koala population overall as healthy, mobile and expansive. Habitat ranges were typically noted to be approximately 6 hectares per koala tagged, with movements highly variable between 60-110m daily. The report found that of the ranges that intersected the Peak Downs Highway overall found a stable and genetically healthy population of Koalas, all of which would be at risk from traffic and infrastructure.

## 1.2 Aims

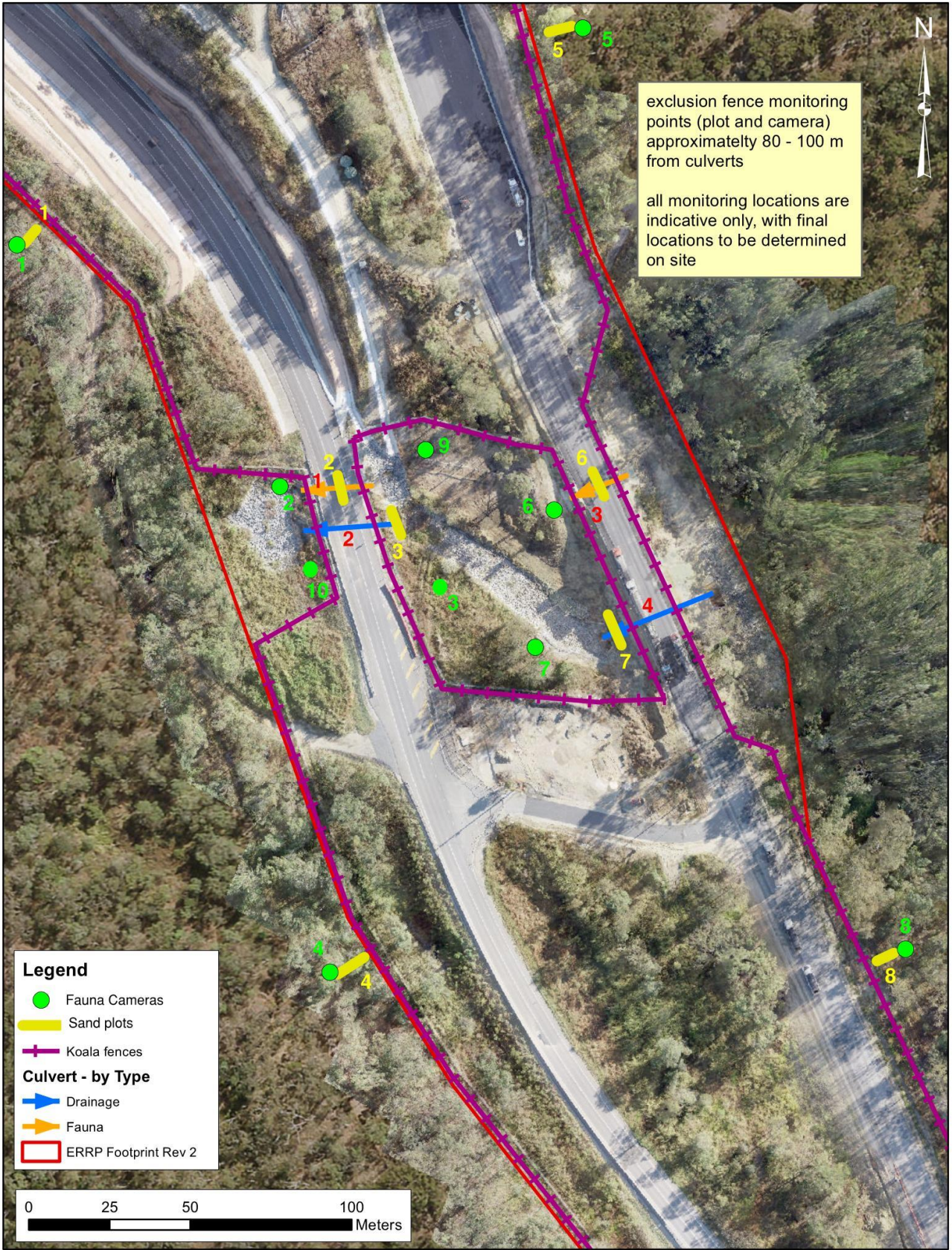
The purpose of the monitoring was to identify:

- The effectiveness of the fauna exclusion fencing and fauna underpasses in providing safe passage for Koalas and other wildlife.
- Identifying potential flaws in the design.
- Noting any recommended modification or future monitoring and maintenance requirements.

Kleinfelder was engaged to provide methodologies and conduct required surveys to monitor and evaluate the effectiveness of the constructed exclusion fencing, culverts, and fauna movement passageways. The following is a brief summary of the results and recommendations (Interim Report – Milestone 1). Works were conducted under Kleinfelder's Scientific Purpose Permit WA00224582.

## 1.3 Study area

The ERRP is located approximately 40 km from Mackay along the Peak Downs Highway. The highway is a major thoroughfare for vehicles travelling to the Bowen Basin in the Isaac Region. The Project has upgraded the infrastructure to reduce hazards associated with vehicles crossing the Eton Range and these works are nearing completion. Fauna exclusion fencing and fauna underpasses have been constructed to mitigate the impacts to fauna movement between the two carriageways and ensure positive connectivity.



exclusion fence monitoring points (plot and camera) approximately 80 - 100 m from culverts

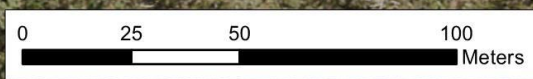
all monitoring locations are indicative only, with final locations to be determined on site

**Legend**

- Fauna Cameras
- Sand plots
- Koala fences

**Culvert - by Type**

- ➔ Drainage
- ➔ Fauna
- ERRP Footprint Rev 2



Branch / Unit : <b>Mackay Whitsunday District</b>	Title : <b>Eton Range Realignment Project Koala fence and culverts Koala Monitoring Locations</b>	
Projection : GDA94	<b>Transport and Main Roads</b>	
File Location: G:\MKYD\Road Corridor\Corridor Management\Environment\Contre	Plan / Job No: 242/33B/8 Date: 07/09/2020	
<small>© The State of Queensland, 2014 Disclaimer: While every care is taken to ensure the accuracy of this data, the above data suppliers and/or the State of Queensland makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including indirect or consequential damage) and costs which you might incur as a result of the data being inaccurate or incomplete in any way and for any reason.</small>	Modified by Kleinfelder 09/08/2021	



## 2 METHOD

Kleinfelder ecologists employed a combination of sand plots and camera traps to monitor fauna traffic between vegetation through culverts. Examples of plot construction are presented in Plates 1-4.

**Table 1: Summary of Field Methods**

Task	Methodology
<b>Sand plots</b>	<ul style="list-style-type: none"> <li>Installed eight sand plots at proposed thoroughfare.               <ul style="list-style-type: none"> <li>Sand plots used were variable in size; the length was determined by culvert or existing track width (2-7m) and was at least 0.4m in width to allow to all stride lengths to be accommodated for and captured. Individual Sand Plot lengths were: 2 = 2.5m, 3 = 5.5m, 6 = 2.5m, 7 = 5.5m and 1, 4, 5 and 8 = 7m.</li> <li>The sand used was called 'Brickie's Loam' which has a high content of clay particles that help retain footprints as the sand dries out.</li> </ul> </li> <li>Three site visits were undertaken weekly for the four-week period.               <ul style="list-style-type: none"> <li>The Brickie's Loam required slight wetting if it was completely desiccated. Excess wetting from rainfall or intervention (i.e. water cart trucks) could have compromised the plot.</li> </ul> </li> <li>All trace evidence of fauna (footprints, direction of travel, scats, etc) was recorded</li> </ul>
<b>Camera Traps</b>	<ul style="list-style-type: none"> <li>Installation of ten motion sensor cameras and additionally 3 provided by TMR</li> <li>Weekly site visit to check photographs and camera quality for the four weeks</li> <li>All evidence of fauna (direction of travel, date and time, species) was recorded</li> </ul>



**Plate 1:** Sand Plot 6 set up in Culvert 3.



**Plate 2:** Sand Plot 3 set up at Culvert 2.



**Plate 3:** Sand Plot 1 set up on fence line.



**Plate 4:** Sand Plot 2 set up in Culvert 1.



# 3 RESULTS AND RECOMMENDATIONS

## 3.1 Results

The four-week period captured a total of 257 fauna interactions, recorded by sand plot (trace) evidence or by camera (direct) behaviour. Of these interactions, at least 40 demonstrated the use of culverts as a thoroughfare by 7 confirmed species and up to 13 additional species that were too cryptic to be identified to species level. A summary of fauna interactions with the culverts is listed below in **Table 2** and **Table 3**. The times for the Swamp Wallaby on the 23/11/20 (8:27-8:47 pm) suggests it was inspecting the culvert before use. Included in this dataset were cameras set up at pedestrian gates adjacent to concrete barriers at 500m (TMR-1) and 620m (TMR-2) north of the culverts on the eastern side of the new highway. These cameras displayed 1 fauna interaction at TMR-2, an Eastern Grey Kangaroo moving parallel to the barrier.

The target species in the area, the Koala (*Phascolarctos cinereus*) was caught in camera traps and their prints detected in sand plots. Although there was no direct indication that any Koalas used the culverts, there is evidence of Koalas travelling along the fence boundary searching for a crossing. While this demonstrates the effectiveness of the exclusion fencing, the appeal of the culverts has to be focused on with vegetation reinforcement and/or easier egress. A full Table of all fauna interactions in the area is provided in **Appendix 1** and **Appendix 2**, in conjunction with the fauna sighted through TMR’s camera traps in **Appendix 3**.

Some sand plots were repeatedly affected by construction works and weather; i.e. water runoff from the water trucks and rain, and human interference (boot prints were found towards the end of the 4-week period). In addition, a limitation of wildlife identification by footprints was difficult because some species within the same Family or Genus have similar weight distribution and foot shape. The quality of sand cannot offset the similarity and subsequently requires the use of cross-checking with previous data and the correlating camera’s data (if any are stationed nearby).

No incidental sightings were recorded, and no roadkill was observed within the project confines during the 4-week monitoring period.

**Table 2: Camera Trap Interactions with Culverts**

Date	Time	Cam #	Species	#	Direction
20/11/20	07:47 pm	C2	<i>Rattus fuscipes</i> / Bush Rat	1	In front of culvert
23/11/20	08:27:50 pm	C2	<i>Wallabia bicolor</i> / Swamp Wallaby	1	To culvert
23/11/20	08:27:53 pm	C2	<i>Wallabia bicolor</i> / Swamp Wallaby	1	Stop at culvert
23/11/20	08:47:13	C2	<i>Wallabia bicolor</i> / Swamp Wallaby	1	Away from culvert
23/11/20	9:03:29 pm	C2	<i>Wallabia bicolor</i> / Swamp Wallaby	1	Into culvert
23/11/20	09:35:58	C2	<i>Wallabia bicolor</i> / Swamp Wallaby	1	Away from culvert
23/11/20	10:09:18 pm	C2	<i>Wallabia bicolor</i> / Swamp Wallaby	1	Away from culvert
24/11/20	12:01:32 am	C2	<i>Wallabia bicolor</i> / Swamp Wallaby	1	On skirt of culvert
28/11/20	12:20 pm	C2	<i>Corvus orru</i> / Torresian Crow	1	In front of culvert
19/11/20	07:17 am	C3	<i>Chlamydosaurus kingii</i> / Frill-necked Lizard	1	In front of culvert
28/11/20	07:18 am	C3	<i>Chlamydosaurus kingii</i> / Frill-necked Lizard	1	In front of culvert
29/11/20	07:19 am	C3	<i>Chlamydosaurus kingii</i> / Frill-necked Lizard	1	In front of culvert
29/11/20	07:20 am	C3	<i>Chlamydosaurus kingii</i> / Frill-necked Lizard	1	In front of culvert
29/11/20	2:19 pm	C3	<i>Corvus orru</i> / Torresian Crow	1	In front of culvert



Date	Time	Cam #	Species	#	Direction
4/12/20	11:31 am	C3	<i>Spilopelia chinensis</i> / Spotted Dove	2	From culvert
5/12/20	12:23 pm	C3	<i>Corvus orru</i> / Torresian Crow	2	Into culvert
22/11/20	01:26 am	C6	<i>Macropus agilis</i> / Agile Wallaby	1	From culvert
22/11/20	02:19 am	C6	<i>Macropus agilis</i> / Agile Wallaby	1	Into culvert

**Table 3: Sand Plot Trap Interactions with Culverts**

Date	Sand Plot Number	Species	#	Direction
25/11/20	S2	<i>Mammalia spp</i> / Mammal species	1	From culvert
25/11/20	S2	<i>Wallabia bicolor</i> / Swamp Wallaby	1	Both ways through culvert
2/12/20	S2	<i>Mammalia spp</i> / Mammal species	2	Into culvert
7/12/20	S2	<i>Chordata spp</i> / Vertebrate species	1	Through culvert
7/12/20	S2	<i>Mammalia spp</i> / Mammal species	1	East through culvert
7/12/20	S2	<i>Mammalia spp</i> / Mammal species	1	East through culvert
9/12/20	S2	<i>Passeriformes spp</i> / Bird species	1	East through culvert
7/12/20	S3	<i>Macropus spp</i> / Macropod species	1	North through culvert
7/12/20	S3	<i>Varanidae spp</i> / Monitor Lizard species	1	North through culvert
9/12/20	S3	<i>Mammalia spp</i> / Mammal species	1	East through culvert
2/12/20	S6	<i>Corvidae spp</i> / Corvid (Crow) species	2	Both ways through culvert
2/12/20	S6	<i>Macropus spp</i> / Macropod species	2	From culvert
9/12/20	S6	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	1	South through culvert
9/12/20	S6	<i>Muridae spp</i> / Rodent species	2	Both ways through culvert
9/12/20	S6	<i>Muridae spp</i> / Rodent species	1	Both ways through culvert
2/12/20	S7	<i>Corvus orru</i> / Torresian Crow	2	Both ways through culvert



**Plate 5: Koala (V) from Camera 1 (Plot 1)**



**Plate 6: Koala from Camera 5 (Plot 5)**





**Plate 7:** Eastern Grey Kangaroo from Camera 5 (Plot 5) **Plate 8:** Lace Monitor from Camera 7 (Culvert 4)



**Plate 9:** Koala prints in Plot 1.



**Plate 10:** *Wallabia bicolor* (Swamp Wallaby) recorded inside culvert on Plot 2 (Culvert 1).

### 3.2 Recommendations

The first collection of data showed a variety of tracks, activity and behavior between wildlife and the culverts. From the field methods used and the records collected, Kleinfelder recommends the following practices be implemented as soon as possible.

The rock basin surrounding culverts (i.e. culvert at Camera 3) to assist with drainage may be altered to improve access and egress. It is recommended that smaller rocks be added to the rock basins to offset the large rocky terrain for fauna. This will benefit terrestrial fauna such as Koalas and macropods' movement between vegetation corridors, as only reptile and bird species were recorded using these terrains.

Additional vegetation cover leading to the culverts would provide encouragement for fauna re-establishment within and between the areas. A sizeable proportion of the area was left unvegetated and exposed to both weather elements and predatory threats. Increased cover will ultimately correlate to higher biodiversity and movement of wildlife.

The planned repeated monitoring program should be implemented prior to the next wet season, as many of sand plot records were compromised by inclement weather events. More concise tracks and identification will be able to be recorded when a monitoring session is undertaken in drier periods.



## 4 CONCLUSION

TMR required monitoring, analysis and reporting on the effectiveness of fauna exclusion fencing and the fauna underpasses constructed for the ERRP. Kleinfelder's ecologists employed a combination of sand plots and camera traps to monitor fauna traffic between vegetation areas and underpass culverts.

The overall effectiveness of the exclusion fencing, and fauna underpasses has shown to be effective; multiple species were found to be using the culverts as a thoroughfare as well as shelter or roosts. Although the effectiveness is making an impact, it is recommended to improve the vegetation and access between the vegetation communities to further bolster the strength of the local communities. Furthermore, additional monitoring should be done outside of the wet season to avoid wash outs and compromised sand plot data for the survey periods.

All data is available for discussion and if any feedback or questions arise, do not hesitate to contact us at Kleinfelder.



## 5 REFERENCES

Ellis, W, Fitzgibbon S., & Barth, B (2018) *Koalas of the Clarke Connors Range: Final report of progress October 2018*. Koala Ecology Group, Brisbane, Queensland.

Melzer A. (2018) *Wildlife mortality on the Nebo to Eton stretch of the Peak Downs Highway, Central Queensland: A report to the Queensland Department of Transport and Main Road*. CQ University, Rockhampton, Queensland.



# APPENDIX 1: FAUNA TABLE OF CAMERA INTERACTIONS

Note: Away = moving away from the culvert; towards = moving towards the culvert.

Camera	Date	Species	Direction	Count	Comments
C1	16/11/2020	<i>Phascolarctos cinereus</i> / Koala	Away	1	At fence, walks away from underpass
C1	17/11/2020	<i>Isodon macrourus</i> / Northern Brown Bandicoot	Away	1	
C1	18/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Towards	1	
C1	30/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Away	1	
C1	30/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Towards and Away	1	
C1	1/12/2020	<i>Phascolarctos cinereus</i> / Koala	Away	1	
C1	2/12/2020	<i>Centropus phasianinus</i> / Pheasant Coucal	Towards	1	
C1	2/12/2020	<i>Phascolarctos cinereus</i> / Koala	Towards and Away	1	
C2	18/11/2020	<i>Vespertilionidae</i> spp.	Across culvert	1	Microbats in holes of culvert infrastructure
C2	20/11/2020	<i>Rattus fuscipes</i> / Bush Rat	From culvert	1	
C2	23/11/2020	<i>Wallabia bicolor</i> / Swamp Wallaby	From culvert	1	
C2	23/11/2020	<i>Wallabia bicolor</i> / Swamp Wallaby	From culvert	1	
C2	23/11/2020	<i>Wallabia bicolor</i> / Swamp Wallaby	From culvert	1	
C2	23/11/2020	<i>Wallabia bicolor</i> / Swamp Wallaby	Into culvert	1	
C2	23/11/2020	<i>Wallabia bicolor</i> / Swamp Wallaby	Into culvert	1	
C2	24/11/2020	<i>Wallabia bicolor</i> / Swamp Wallaby	Into culvert	1	
C2	28/11/2020	<i>Corvus orru</i> / Torresian Crow	From culvert	1	
C2	2/12/2020	<i>Centropus phasianinus</i> / Pheasant Coucal	Towards	2	
C2	6/12/2020	<i>Phascolarctos cinereus</i> / Koala	Away	1	
C3	16/11/2020	<i>Corvus orru</i> / Torresian Crow	N/A	1	
C3	18/11/2020	<i>Corvus orru</i> / Torresian Crow	N/A	1	
C3	19/11/2020	<i>Agamidae</i> spp.	From culvert	1	Dragon species in rock basin
C3	19/11/2020	<i>Corvus orru</i> / Torresian Crow	N/A	2	
C3	19/11/2020	<i>Corvus orru</i> / Torresian Crow	N/A	1	
C3	20/11/2020	<i>Corvus orru</i> / Torresian Crow	N/A	1	
C3	21/11/2020	<i>Corvus orru</i> / Torresian Crow	N/A	1	
C3	22/11/2020	<i>Corvus orru</i> / Torresian Crow	N/A	1	



Camera	Date	Species	Direction	Count	Comments
C3	28/11/2020	<i>Chlamydosaurus kingii</i> / Frill-necked Lizard	From culvert	1	
C3	29/11/2020	<i>Chlamydosaurus kingii</i> / Frill-necked Lizard	From culvert	1	
C3	29/11/2020	<i>Corvus orru</i> / Torresian Crow	From culvert	1	
C3	29/11/2020	<i>Chlamydosaurus kingii</i> / Frill-necked Lizard	Into culvert	1	
C3	4/12/2020	<i>Spilopelia chinensis</i> / Spotted Dove	From culvert	2	Breeding pair
C3	4/12/2020	<i>Corvus orru</i> / Torresian Crow	Towards	2	
C3	5/12/2020	<i>Corvus orru</i> / Torresian Crow	Across culvert	3	Seeking shade, no thoroughfare
C3	5/12/2020	<i>Corvus orru</i> / Torresian Crow	Into culvert	2	
C4	19/11/2020	<i>Macropus agilis</i> / Agile Wallaby	N/A	1	
C4	30/11/2020	<i>Wallabia bicolor</i> / Swamp Wallaby	Away	1	
C4	9/12/2020	<i>Burhinus grallarius</i> / Bush-stone Curlew	Away	1	
C5	17/11/2020	<i>Elapidae spp.</i>	Towards	1	Likely Elapid crossing
C5	18/11/2020	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	Away	1	
C5	19/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Both	1	
C5	20/11/2020	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	Away	1	Other side of fence
C5	20/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Towards	1	
C5	20/11/2020	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	Towards	1	Other side of fence
C5	22/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Away	1	10 minute camera interaction
C5	22/11/2020	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	Away	1	Other side of fence
<b>C5</b>	22/11/2020	<i>Phascolarctos cinereus</i> / Koala	Away	1	
C5	22/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Both	1	
C5	22/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Towards	1	Other side of fence
C5	22/11/2020	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	Towards	1	
C5	22/11/2020	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	Towards	1	
C5	22/11/2020	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	Towards and Away	1	Other side of fence
C5	22/11/2020	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	Towards and Away	1	Other side of fence
C5	22/11/2020	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	Towards and Away	1	Other side of fence
C5	22/11/2020	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	Towards and Away	1	Other side of fence
C5	23/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Away	1	
C5	23/11/2020	<i>Wallabia bicolor</i> / Swamp Wallaby	Away	1	



Camera	Date	Species	Direction	Count	Comments
C5	23/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Both	1	
C5	23/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Towards	1	Other side of fence
C5	23/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Towards and Away	3	
C5	23/11/2020	<i>Wallabia bicolor</i> / Swamp Wallaby	Towards and Away	1	
C5	26/11/2020	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	N/A	1	Other side of fence
C5	27/11/2020	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	N/A	1	Other side of fence
C5	28/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Towards and Away	1	Looking to cross fence
<b>C5</b>	28/11/2020	<i>Phascolarctos cinereus</i> / Koala	Towards and Away	1	Looking to cross fence
C5	29/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Away	1	
C5	30/11/2020	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	N/A	1	Other side of fence
C5	30/11/2020	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	N/A	1	Other side of fence
C5	30/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Towards	3	1 Joey
C5	4/12/2020	<i>Macropus agilis</i> / Agile Wallaby	Away	2	Interacting across fence
C5	4/12/2020	<i>Macropus agilis</i> / Agile Wallaby	N/A	1	Other side of fence
C5	6/12/2020	<i>Corvus orru</i> / Torresian Crow	Away	2	Interacting across fence
C6	17/11/2020	<i>Corvus orru</i> / Torresian Crow	N/A	1	
C6	18/11/2020	<i>Corvus orru</i> / Torresian Crow	N/A	1	
C6	18/11/2020	<i>Corvus orru</i> / Torresian Crow	N/A	1	
C6	22/11/2020	<i>Macropus agilis</i> / Agile Wallaby	From culvert	1	Juvenile
C6	22/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Into culvert	1	
C6	1/12/2020	<i>Corvus orru</i> / Torresian Crow	Away	1	
C6	1/12/2020	<i>Macropus agilis</i> / Agile Wallaby	Towards	1	Juvenile exiting culvert
C6	2/12/2020	<i>Macropus agilis</i> / Agile Wallaby	Away	1	Juvenile re-entering culvert
C6	3/12/2020	<i>Rhinella marinus</i> / Cane Toad	N/A	1	Invasive
C6	5/12/2020	<i>Corvus orru</i> / Torresian Crow	Away	1	
C6	5/12/2020	<i>Corvus orru</i> / Torresian Crow	Towards	1	
C7	19/11/2020	<i>Corvus orru</i> / Torresian Crow	N/A	1	
C7	20/11/2020	<i>Muridae spp.</i>	Across culvert	1	Rodent species
C7	21/11/2020	<i>Rhinella marinus</i> / Cane Toad	Across culvert	1	
C7	29/11/2020	<i>Varanus varius</i> / Lace Monitor	Away	1	Enters Culvert



Camera	Date	Species	Direction	Count	Comments
C7	2/12/2020	<i>Rhinella marinus</i> / Cane Toad	Away	2	Invasive
C7	8/12/2020	<i>Corvus orru</i> / Torresian Crow	N/A	1	
C8	18/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Towards	1	
C8	19/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Away	1	
C8	21/11/2020	<i>Centropus phasianinus</i> / Pheasant Coucal	N/A	1	
C8	23/11/2020	<i>Macropus agilis</i> / Agile Wallaby	N/A	1	
C8	26/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Towards	1	
C8	28/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Away	1	
C8	29/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Away	3	
C8	29/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Towards	1	
C8	1/12/2020	<i>Macropus agilis</i> / Agile Wallaby	Away	1	
C8	3/12/2020	<i>Macropus agilis</i> / Agile Wallaby	Towards	1	
C8	8/12/2020	<i>Macropus agilis</i> / Agile Wallaby	Away	1	
C8	10/12/2020	<i>Macropus agilis</i> / Agile Wallaby	Away	1	
C8	10/12/2020	<i>Centropus phasianinus</i> / Pheasant Coucal	Towards	1	
C9	2/12/2020	<i>Corvus orru</i> / Torresian Crow	N/A	2	



## APPENDIX 2: FAUNA TABLE OF SAND PLOT INTERACTIONS

Camera	Date	Species	Direction	Count	Comments
S1	17/11/2020	<i>Phascolarctos cinereus</i> / Koala	Away	1	
S1	17/11/2020	<i>Passeriformes</i> spp.	N/A	1	Small sized bird species
S1	18/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Towards	1	
S1	25/11/2020	<i>Macropus</i> spp.	Away	1	Not on Camera
S1	25/11/2020	<i>Mammalia</i> spp.	Away	1	
S1	27/11/2020	<i>Isodon macrourus</i> / Northern Brown Bandicoot	Away	1	
S1	27/11/2020	<i>Muridae</i> spp.	Away	1	Rodent species
S1	30/11/2020	<i>Corvus orru</i> / Torresian Crow	Away	1	
S1	30/11/2020	<i>Isodon macrourus</i> / Northern Brown Bandicoot	Away	1	
S1	30/11/2020	<i>Wallabia bicolor</i> / Swamp Wallaby	Away	1	
S1	30/11/2020	<i>Wallabia bicolor</i> / Swamp Wallaby	Away	1	
S1	30/11/2020	<i>Chordata</i> spp.	Towards	1	Indiscernible species
S1	2/12/2020	<i>Centropus phasianinus</i> / Pheasant Coucal	N/A	2	
S1	2/12/2020	<i>Phascolarctos cinereus</i> / Koala	Towards and away	1	Intermittently caught thrice on camera
S1	2/12/2020	<i>Wallabia bicolor</i> / Swamp Wallaby	Towards and away	2	
S1	4/12/2020	<i>Phascolarctos cinereus</i> / Koala	Away	1	Not on Camera
S1	7/12/2020	<i>Mammalia</i> spp.	Away	1	Bettong or Macropod species
S1	7/12/2020	<i>Phascolarctos cinereus</i> / Koala	Away	1	
S1	7/12/2020	<i>Mammalia</i> spp.	N/A	1	Small sized Mammal species
S1	7/12/2020	<i>Mammalia</i> spp.	Towards	1	Medium sized mammal species
S2	20/11/2020	<i>Rattus fuscipes</i> / Bush rat	Towards	1	
S2	20/11/2020	<i>Trichosurus vulpecula</i> / Brushtail Possum	Towards	1	Plot affected by rain event
S2	23/11/2020	<i>Muridae</i> spp.	Towards	1	Rodent species
S2	25/11/2020	<i>Wallabia bicolor</i> / Swamp Wallaby	Both ways through culvert	1	
S2	25/11/2020	<i>Mammalia</i> spp.	From culvert	1	Rakali (water rat) or Bandicoot
S2	27/11/2020	<i>Mammalia</i> spp.	Towards	1	Likely a macropod species
S2	30/11/2020	<i>Mammalia</i> spp.	Towards	1	Indiscernible Mammal species





Camera	Date	Species	Direction	Count	Comments
S2	2/12/2020	<i>Mammalia spp.</i>	Into culvert	2	Mammal species
S2	4/12/2020	<i>Chordata spp.</i>	Both	1	Indiscernible Mammal species
S2	7/12/2020	<i>Chordata spp.</i>	East or west through culvert	1	Small sized vertebrate species
S2	7/12/2020	<i>Mammalia spp.</i>	East through culvert	1	Medium sized mammal species
S2	7/12/2020	<i>Mammalia spp.</i>	East through culvert	1	Small sized Mammal species
S2	9/12/2020	<i>Muridae spp.</i>	Both	1	Plot affected by rain event - Rodent Species
S2	9/12/2020	<i>Passeriformes spp.</i>	East through culvert	1	Indiscernible bird species
S2	11/12/2020	<i>Rhinella marinus</i> / Cane Toad	N/A	1	Invasive
S3	17/11/2020	<i>Corvus orru</i> / Torresian Crow	N/A	2	
S3	18/11/2020	<i>Mammalia spp.</i>	Both	1	Small sized Mammal species
S3	18/11/2020	<i>Corvidae spp.</i>	N/A	1	Not on camera - likely Torresian Crow
S3	18/11/2020	<i>Passeriformes spp.</i>	N/A	1	Small sized bird species
S3	23/11/2020	<i>Corvus orru</i> / Torresian Crow	Both	1	
S3	23/11/2020	<i>Muridae spp.</i>	Towards	1	Rodent species
S3	23/11/2020	<i>Wallabia bicolor</i> / Swamp Wallaby	Towards	1	
S3	25/11/2020	<i>Mammalia spp.</i>	Away	2	Plot affected by rain event
S3	30/11/2020	<i>Corvus orru</i> / Torresian Crow	N/A	1	
S3	30/11/2020	<i>Muridae spp.</i>	Towards	1	Rodent species
S3	7/12/2020	<i>Corvus orru</i> / Torresian Crow	Both	1	
S3	7/12/2020	<i>Muridae spp.</i>	Both	1	Rodent species
S3	7/12/2020	<i>Mammalia spp.</i>	Both	3	Small sized Mammal species
S3	7/12/2020	<i>Macropus spp.</i>	North through culvert	1	Likely Eastern Grey Kangaroo
S3	7/12/2020	<i>Varanidae spp.</i>	North through culvert	1	Monitor species
S3	9/12/2020	<i>Mammalia spp.</i>	East through culvert	1	Small sized Mammal species
S3	11/12/2020	<i>Corvus orru</i> / Torresian Crow	N/A	1	Plot affected by rain event
S4	17/11/2020	<i>Passeriformes spp.</i>	N/A	1	Medium sized bird species
S4	20/11/2020	<i>Isoodon macrourus</i> / Northern Brown Bandicoot	Away	1	Plot affected by rain event
S4	20/11/2020	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	Away	1	Plot affected by rain event
S4	23/11/2020	<i>Muridae spp.</i>	Towards	1	Rodent species
S4	25/11/2020	<i>Mammalia spp.</i>	Away	2	



Camera	Date	Species	Direction	Count	Comments
S4	27/11/2020	<i>Chlamydosaurus kingii</i> / Frill-necked Lizard	Towards	1	
S4	30/11/2020	<i>Wallabia bicolor</i> / Swamp Wallaby	Towards	1	
S4	2/12/2020	<i>Corvidae spp.</i>	N/A	2	Corvid species, likely Torresian Crow
S4	2/12/2020	<i>Wallabia bicolor</i> / Swamp Wallaby	Towards	1	
S4	7/12/2020	<i>Corvus orru</i> / Torresian Crow	N/A	1	
S4	7/12/2020	<i>Mammalia spp.</i>	N/A	1	Small sized Mammal species
S4	7/12/2020	<i>Macropus agilis</i> / Agile Wallaby	Towards	1	
S5	17/11/2020	<i>Chlamydosaurus kingii</i> / Frill-necked Lizard	Away	1	
S5	17/11/2020	<i>Corvus orru</i> / Torresian Crow	Away	1	
S5	18/11/2020	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	Away	1	
S5	20/11/2020	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	Towards	1	
<b>S5</b>	20/11/2020	<i>Phascolarctos cinereus</i> / Koala	Towards	1	Hit plot and went inland
S5	23/11/2020	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	Away	1	
S5	23/11/2020	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	Towards	1	
S5	23/11/2020	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	Towards	1	
S5	25/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Away	3	
S5	25/11/2020	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	Away	1	
S5	25/11/2020	<i>Muridae spp.</i>	Away	1	Rodent species
S5	27/11/2020	<i>Muridae spp.</i>	Towards	1	Rodent species
S5	30/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Towards	1	High macropod activity
S5	30/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Towards	1	High macropod activity
<b>S5</b>	30/11/2020	<i>Phascolarctos cinereus</i> / Koala	Towards and Away	1	
S5	2/12/2020	<i>Macropus agilis</i> / Agile Wallaby	Away	1	
S5	2/12/2020	<i>Macropus agilis</i> / Agile Wallaby	Towards	2	
S5	4/12/2020	<i>Macropus agilis</i> / Agile Wallaby	Towards	1	
S5	4/12/2020	<i>Varanidae spp.</i>	Towards	1	Monitor species
S5	7/12/2020	<i>Macropus agilis</i> / Agile Wallaby	Away	1	
S5	7/12/2020	<i>Corvus orru</i> / Torresian Crow	N/A	1	
S5	7/12/2020	<i>Mammalia spp.</i>	N/A	1	Small sized Mammal species
S5	7/12/2020	<i>Squamata spp.</i>	Towards	1	Lizard species



Camera	Date	Species	Direction	Count	Comments
S6	18/11/2020	<i>Corvus orru</i> / Torresian Crow	Away	1	
S6	20/11/2020	<i>Muridae spp.</i>	Away	1	Plot affected by rain event - Rodent Species
S6	20/11/2020	<i>Muridae spp.</i>	Away	1	Plot affected by rain event - Rodent Species
S6	23/11/2020	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	Towards	1	Entering culvert from the centre garden
S6	23/11/2020	<i>Macropus spp.</i>	Towards	1	Likely Eastern Grey Kangaroo
S6	23/11/2020	<i>Muridae spp.</i>	Towards	1	Rodent species
S6	30/11/2020	<i>Chordata spp.</i>	Towards	1	Indiscernible species
S6	2/12/2020	<i>Corvidae spp.</i>	Both ways through culvert	2	Corvid species, likely Torresian Crow
S6	2/12/2020	<i>Macropus spp.</i>	From culvert	2	Not on Camera
S6	2/12/2020	<i>Chordata spp.</i>	N/A	1	Indiscernible tracks
S6	4/12/2020	<i>Muridae spp.</i>	Both	1	Plot affected by rain event - Rodent Species
S6	4/12/2020	<i>Squamata spp.</i>	Towards	1	Plot affected by rain event - Reptile Species
S6	7/12/2020	<i>Mammalia spp.</i>	N/A	1	Small sized Mammal species
S6	9/12/2020	<i>Muridae spp.</i>	Both ways through culvert	2	Rodent species
S6	9/12/2020	<i>Muridae spp.</i>	Both ways through culvert	1	Rodent species
S6	9/12/2020	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	South through culvert	1	
S6	11/12/2020	<i>Passeriformes spp.</i>	N/A	1	Indiscernible bird species
S7	17/11/2020	<i>Passeriformes spp.</i>	N/A	1	Likely Welcome Swallow
S7	25/11/2020	<i>Corvidae spp.</i>	N/A	1	Plot affected by rain event - likely Torresian Crow
S7	30/11/2020	<i>Varanus varius</i> / Lace Monitor	Both	1	
S7	30/11/2020	<i>Rhinella marinus</i> / Cane Toad	Towards	1	Invasive
S7	2/12/2020	<i>Corvus orru</i> / Torresian Crow	Both ways through culvert	2	
S7	7/12/2020	<i>Mammalia spp.</i>	N/A	3	Small sized Mammal species
S8	17/11/2020	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	Away	1	
S8	20/11/2020	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	Towards	1	
S8	27/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Towards	1	High activity within sand plot
S8	30/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Away	1	Plot affected by rain event
S8	30/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Away	1	Plot affected by rain event
S8	30/11/2020	<i>Macropus agilis</i> / Agile Wallaby	Away	1	Plot affected by rain event
S8	30/11/2020	<i>Macropus giganteus</i> / Eastern Grey Kangaroo	Towards	1	Plot affected by rain event



Camera	Date	Species	Direction	Count	Comments
S8	4/12/2020	<i>Macropus agilis</i> / Agile Wallaby	Away	1	
S8	4/12/2020	<i>Macropus agilis</i> / Agile Wallaby	Towards	1	Not on Camera



## APPENDIX 3: FAUNA TABLE OF TMR CAMERA TRAPS

Camera	Date	Species	Direction	Count	Comments
TMR-2	29/11/20	Macropus giganteus / Eastern Grey Kangaroo	Away	1	Captured at 01:26am