2020 MALLEEFOWL MONITORING

Covalent Lithium

ecoscape

Revision	Author	QA Reviewer	Approved	Date
Final Rev 1	Bruce Turner	Sonya Bateman Associate Spatial Planner	Sonya Bateman Associate Spatial Planner	27/11/2021

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SUMMARY

Ecoscape was engaged by Covalent Lithium in August 2020 to provide the following services for the project:
- undertake National Malleefowl Recovery Team (NMRT) Malleefowl mound monitoring for the 2020-21 monitoring period
- collate images of fauna species and activity from Malleefowl mounds.

The results of the Malleefowl mound monitoring and review of the recorded images of Malleefowl at mounds has provided baseline data that can be used to compare future monitoring results for the Covalent Earl Grey Lithium Project site.

Selected LiDAR data points were ground truthed to determine mound status. Nine new Malleefowl mounds were identified from LiDAR results and added to the list of known Malleefowl mounds, these were measured for the first time during this 2020-21 Malleefowl monitoring period.

The 2020-21 monitoring period recorded one active mound within the development envelope (DE) and one active mound outside the DE. There are 14 mounds that recorded Malleefowl activity during the 2020-21 monitoring period in comparison to six mounds with recorded Malleefowl activity in 2019-20.

An activity analysis indicated there are two breeding pairs within the monitoring area. Activity patterns also suggest another breeding pair of Malleefowl in the northwest of the monitoring area. Activity patterns are compared between years showing a marked increase in activity during 2020-21.

Trail cameras identified four different Malleefowl mounds were visited by Feral Cats. This included both active and inactive Malleefowl mounds.

To provide Malleefowl population health and abundance data the following aspects are recommended to be monitored annually:
- trail camera monitoring during the egg incubation season (September to January) of all Malleefowl mounds that have been identified as annual, within and adjacent to the development envelope
- maintain database of Malleefowl and other fauna species sightings within a fauna register and report annually on number and location of active mounds
- collate image data and report on status of all monitored mounds
- collate and report on records of sightings of feral predators and images captured on cameras at the monitored mounds
- complete ground truthing of LiDAR data within the development envelope opportunistically.

1   INTRODUCTION

Covalent Lithium is developing the Earl Grey Lithium Project (EGLP) located at Mt Holland which will include the construction and operation of a fully integrated mine, concentrator, and refinery in Western Australia. The project is centred on the Earl Grey hard-rock lithium deposit 105 km south of Southern Cross in Western Australia and approximately 500 km east of Perth. It is owned by a 50-50 joint venture (JV) between subsidiaries of Wesfarmers Pty Ltd (WES:ASX) and Sociedad Química y Minera de Chile S.A. (SQM: NYSE). Covalent is the manager for the JV and is responsible for the development and operation of the project.

The survey area includes the habitats of two conservation significant fauna species, the Malleefowl (*Leipoa ocellata*) and the Chuditch (*Dasyurus geoffroii*). Both species are listed as vulnerable (VU) under both the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the Western Australian *Biodiversity Conservation Act 2016* and are considered as Matters of National Environmental Significance (MNES).

Monitoring of Malleefowl mounds was undertaken during the mound building and egg laying summer season in 2019-20 and again in 2020-21. Mounds identified as Annual and five-year monitoring were revisited in 2020-21 and remeasured. Trail cameras were deployed on mounds to capture activity of Malleefowl and other fauna species including feral predators.

1.1   PROJECT SCOPE

Ecoscape was engaged in August 2020 to provide the following:
- monitoring of known Malleefowl mounds
- ground truthing of LiDAR results for potential Malleefowl mounds.

The requirements of the field survey were as follows:
- be conducted in accordance with current statutory and technical requirements and guidance, as outlined below
- be conducted by personnel complying with regulatory expectations in relation to years of experience to ground truth the desktop findings through a comprehensive and targeted survey
- identify, map and measure Malleefowl mounds to NMRT standards
- install and deploy trail cameras on mounds considered for annual and five year monitoring.

1.2   SURVEY AREA

1.2.1   REGIONAL LOCATION

The survey area is located in the Shire of Yilgarn in the Goldfields region of Western Australia, about 100km south of Southern Cross. The development envelope (DE) is within the Great Western Woodlands (GWW) and is approximately 1,984 ha in extent (**Map 1**). The GWW is a 16 million hectare area extending from the wheatbelt to the edge of the deserts and is the largest intact area of Mediterranean Woodland on earth (DEC 2010). The GWW includes open eucalypt woodlands (63%), Mallee eucalypt woodlands, shrublands and grasslands (Fox et al. 2016). Less common habitats in the GWW include granite outcrops, banded ironstone formations, salt lakes and freshwater wetlands (Fox et al. 2016).

The DE is in the Southern Cross Subregion of the Coolgardie Bioregion of the Interim Biogeographic Regionalism for Australia (IBRA) classification system (Government & Energy 2017). The dominant land-uses in this bioregion are Crown Reserves and Unallocated Crown Land (66.7%), grazing on native pastures (17%), conservation (11.5%) and dryland agriculture (2.3%) (Cowan, Graham & McKenzie 2001). The greenstone hills, alluvial valleys and broad plains of calcareous earths support diverse eucalypt woodlands. The uplands support Mallee woodlands and scrub-heaths on sandplains, gravelly sandplains and lateritic breakaways, chains of salt lakes with dwarf shrublands of samphire occur in the valleys (Cowan, Graham & McKenzie 2001).

1.3   STATUTORY AND TECHNICAL FRAMEWORK

This environmental assessment was conducted in accordance with Commonwealth and State legislation and guidelines:

- Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)
- Western Australian Environmental Protection Act 1986 (EP Act)
- Western Australian Biodiversity Conservation Act 2016 (BC Act)
- Department of Environment Water Heritage and the Arts *Matters of National Environmental Significance. Significant impact guidelines 1.1 - Environment Protection and Biodiversity Conservation Act 1999* (DEWHA 2009).

In addition, the Minister for the Environment has published lists of fauna species in need of special protection because they are considered rare, likely to become extinct, or are presumed extinct. The current listings were published in the Government Gazette on 11 September 2018 (Government of Western Australia 2018) and was taken into account.

As well as those listed above, the assessment complied with EPA requirements for environmental survey and reporting in Western Australia, as outlined in:

- EPA Technical Guidance - Terrestrial Fauna Surveys, known as the Fauna Technical Guidance
- EPA Technical Guidance - Sampling Methods for Terrestrial Vertebrate Fauna.

1.3.1   COMMONWEALTH ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

At a Commonwealth level, threatened taxa (flora and fauna) are protected under the EPBC Act, which lists species that are considered Critically Endangered, Endangered, Vulnerable, Conservation Dependant, Extinct, or Extinct in the Wild.

1.3.2   WESTERN AUSTRALIAN ENVIRONMENTAL PROTECTION ACT 1986

The Western Australian EP Act was created to provide for an Environmental Protection Authority (EPA) that has the responsibility for:

- prevention, control and abatement of pollution and environmental harm
- conservation, preservation, protection, enhancement, and management of the environment
- matters incidental to or connected with the above.

The EPA is responsible for providing the guidance and policy under which environmental assessments are conducted. It conducts environmental impact assessments (based on the information included in environmental assessments and provided by the proponent), initiates measures to protect the environment and provides advice to the Minister responsible for environmental matters.

1.3.3   WESTERN AUSTRALIAN BIODIVERSITY CONSERVATION ACT 2016

The Western Australian BC Act provides for the conservation, protection and ecologically sustainable use of biodiversity and biodiversity components in Western Australia. It commenced on 1 January 2019.

Threatened species (both flora and fauna) and ecological communities that meet the categories listed within the BC Act are highly protected and require authorisation by the Minister to take or disturb. These are known as Threatened Flora, Threatened Fauna and Threatened Ecological Communities. The conservation categories of Critically Endangered, Endangered and Vulnerable have been aligned with those detailed in the EPBC Act.

Flora and fauna species may be listed as being of special conservation interest if they have a naturally low population, restricted natural range, are subject to or recovering from a significant population decline or reduction of range or are of special interest, and the Minister considers that taking may result in depletion of the species. Migratory species and those subject to international agreements are also listed under the Act. These are known as specially protected species in the BC Act.

The most recent flora and fauna listings were published in the Government Gazette on 11 September 2018 (Government of Western Australia 2018).

1.3.4   WESTERN AUSTRALIAN PRIORITY FAUNA

Conservation significant fauna species are listed by the DBCA as Priority Fauna where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to threatened fauna categories. Whilst Priority Fauna are not specifically listed in the BC Act, these have a greater level of significance than other native species.

1.3.5   DBCA WILDLIFE LICENCES

The field survey for the 2020 Malleefowl monitoring program was undertaken by Ecoscape Principal Zoologist Bruce Turner and Zoologist Hugh Osborn under DBCA Wildlife Licensing Fauna License No. BA27000085-3 and Threatened Fauna Authority TFA 2020-0070. Copies of these licences can be found in **Appendix Three**.

2 METHOD

The purpose of the 2020-21 Malleefowl monitoring was to collect monitoring data on all Malleefowl mounds within the DE classified as ANNUAL or 5 YR as on-going monitoring of Malleefowl presence and to deploy trail cameras on selected mounds. This is the second season of monitoring which commenced in the mound building season of 2019-20.

The 2020-21 Malleefowl monitoring was undertaken by Ecoscape zoologists Bruce Turner and Hugh Osborn under DBCA Wildlife License No. BA27000085-3 between 14-18 October 2020.

2.1.1 MALLEEFOWL MONITORING

Malleefowl mounds previously identified in the 2019 monitoring were revisited (Ecoscape 2019), remeasured and assessed to determine current activity status. LiDAR results were also ground truthed for accuracy and new mounds were added to the mound database and measured to NMRT standards.

At each Malleefowl mound measured a series of criteria was addressed as stated in section three of the NMRT Monitoring Manual. Each mound was recorded as either active or inactive and given a mound profile. A series of measurements and observations were recorded. Mounds were marked with a numbered star picket, photographed and cross sticks were left in place over the mound for future monitoring events. A 20 m radius was searched around active mounds only for any signs of predation.

2.1.2 TRAIL CAMERA MONITORING

Trail cameras were mounted at mounds which were assessed as currently active or had evidence of recent activity within and outside of the DE. Cameras were mounted on brackets attached to star pickets installed close to the mound and high enough off the ground to view the interior of the mound.

Image 1: Monitored mound showing location of post and camera

The cameras were deployed from late October 2020 to March 2021. Images from the trail cameras were downloaded for review and collation of species recorded.

Recorded images of Malleefowl were analysed to determine areas of Malleefowl activity. This was achieved by logging the number of activity events recorded at each mound. An activity event is defined as an image, or group of images, separated by at least two hours between images. The results were then analysed using a GIS heat map based on the number of events recorded for each mound.

2.1.3   LIDAR DATA

Ground truthing of LiDAR results was undertaken along the Blue Vein Haul Road during a fauna survey. LiDAR points determined to be Malleefowl mounds, either recent or historical, were added to the mound database and measured to NMRT standards.

As outlined within Anditi (2021, **Appendix Four**) Aerial LiDAR data covering the DE and surrounds was captured by McMullen Nolan Group Pty Ltd (MNG Survey) in July/August 2019. The LiDAR data consisted of aerial LiDAR at a nominally 120 m aircraft flight line spacing to record a minimum of 5 detection points per square meter.

Spatial analytics company Anditi Pty Ltd then analysed the MNG Survey data to identify potential Malleefowl nest mounds through automation via the 'Anditi Engine'; being the proprietary software developed by Anditi data scientists for smart point cloud and image processing. In this process, the ground is defined through classification algorithms and then Malleefowl mound detection algorithms are applied to the ground surface to detect ground features in the point cloud that best approximate a typical Malleefowl nest mound shape. Based on the algorithm match to shape, and manual checks of aerial imagery, a mound is classed from Class 1 to Class 4, being:

Class 1 - Very closely matches a typical Malleefowl nest mound shape and is <u>highly likely</u> to be a Malleefowl nest mound

Class 2 - Is similar to a Malleefowl nest mound shape and <u>could</u> be a Malleefowl nest mound

Class 3 - Is a nest mound shape that is approximately within the parameters of size for a Malleefowl nest mound but <u>isn't very similar</u> to a typical Malleefowl nest mound. This could be an old Malleefowl nest mound, a mound of earth around living or dead tree/vegetation, or natural hummocks around waterways

Class 4 - Is a nest mound shape that is approximately within the parameters of size for a Malleefowl nest mound but <u>isn't very similar</u> to a typical Malleefowl mounds. This could be a broken Malleefowl nest mound, a mound of earth around living or dead tree/vegetation, natural hummocks around waterways, or tussock vegetation, with manual aerial imagery checking.

A digital elevation model (DEM) is created and contoured to highlight ground features. This is overlaid with the 3D LIDAR point cloud in the Anditi Editor so that manual editors can review the data from all angles. In some cases, the point cloud is coloured from the RGB colour orthophoto. All these options enhance the quality of the resulting rated mounds, removing vegetation and other false positives. All Class 1 and Class 2, and some Class 3 mounds, were checked manually by Anditi using all available methods (e.g., aerial imagery) and where false positives were detected, these were moved to Class 4.

All potential Malleefowl nest mounds identified by LiDAR as Class 1, Class 2 and Class 3 within the Indicative Site Layout (disturbance footprint) for proposed mining operations were ground-truthed by Ecoscape to determine if the locations contained a Malleefowl nest mound (or not). Points identified as Class 4 were not ground-truthed as these locations were considered unlikely to contain a Malleefowl nest mound.

Further detail on the LiDAR data collection and processing is contained within Anditi (2021) provided at **Appendix Four**.

3 RESULTS

3.1 MALLEEFOWL MOUND MONITORING

A total of 40 Malleefowl mounds classified as ANNUAL or 5 YR, and nine new mounds were measured to NMRT standards during the 2020-21 monitoring period (**Table 4 Appendix Two**). Twenty-six of these are within the DE and 23 are outside the DE (**Map 1**). Two mounds were recorded as ACTIVE (mound building and egg laying recorded), mound MM53 inside the DE, and mound MM64 outside the DE (**Map 2**). Of the 49 measured mounds, 41 were monitored by trail camera, 26 inside the DE and 15 outside the DE (**Map 3**, **Table 1**).

Table 1: Malleefowl mounds trail camera monitored 2020-21

Monitoring Frequency	Mound Location	
	Inside DE	Outside DE
ANNUAL	15	12
5 YR	11	3
Total	**26**	**15**

Table 2 lists the results for the previous year's monitoring of 2019-20. The number of mounds between years differ in that DNM mounds (mounds determined not to be built by Malleefowl) were not revisited in 2020-21. Only those mounds classified as ANNUAL and 5 YR were remeasured, as per NMRT standards, and new Malleefowl mounds that were added from the LiDAR ground truthing were included in the 2020-21 monitoring.

Table 2: Malleefowl mounds trail camera monitored 2019-20

Monitoring Frequency	Mound Location	
	Inside DE	Outside DE
ANNUAL	16	12
5 YR	13	3
Do Not Monitor (DNM)	14	7*
Total	**43**	**22**

Of the 41 trail camera monitored mounds one mound (MM53) was recorded as active (i.e. recorded mound building and egg laying activity) within the DE and one mound (MM64) was recorded as active outside the DE. The remaining 39 mounds, within and outside the DE, were inactive (i.e. no recorded mound building or egg laying activity) (**Table 4** in **Appendix One**).

Twelve mounds, seven inside the DE and five outside the DE, recorded Malleefowl visiting the mounds with no mound building or egg laying activity being recorded (**Table 3**). In comparison, the 2019-20 monitoring recorded six mounds with Malleefowl visits. There has been a two-fold increase recorded in Malleefowl activity.

3.2 TRAIL CAMERA IMAGE REVIEW

A total of 41 trail cameras were placed at active mounds and mounds which had been active approximately within the past five years, 26 of these are located within the DE and 15 are located outside the DE (**Map 3**). **Table 4** in **Appendix Two** lists the locations for all Malleefowl mounds monitored during the survey and the mounds at which trail cameras were placed (**Map 3**).

All the cameras were revisited in January 2021 to have batteries replaced and image data downloaded and were then subsequently collected in March 2021. The downloaded data was collated into folders for each monitored mound and then reviewed. The review process involved removing images with no fauna present (e.g., wind moving shrubs) and then sorting images with fauna present into species subfolders.

Table 5 (**Appendix Two**) lists all species recorded by the trail cameras at the monitored mounds. Varanid species, Dingo and Feral Cat were recorded on mounds indicating predators of Malleefowl eggs were active at the time of survey.

3.2.1 MALLEEFOWL

Images of Malleefowl were reviewed for behaviour, e.g. scratching or egg laying, with the number of activity events tabulated. Results are discussed with respect to possible abundance based on timing of image capture.

Fourteen (eight inside DE; six outside DE) camera monitored Malleefowl mounds recorded Malleefowl and were mapped to indicate their spatial relationship to each other. One active mound (MM53) was inside the DE, and one active mound (MM64) was recorded outside the DE (**Map 2**).

Table 3: Malleefowl mounds that recorded activity

Mound ID	Number of recorded activity events	Monitoring Frequency	Inside DE (yes/no)	Feral Predators
MM06	1	5 YR	Yes	
MM17	2	ANNUAL	No	Yes
MM23	2	ANNUAL	Yes	
MM24	7	ANNUAL	No	Yes
MM28	1	5 YR	Yes	
MM42	4	ANNUAL	Yes	
MM53 ACTIVE	Constant (>100)	ANNUAL	Yes	
MM56	6	ANNUAL	Yes	
MM58	1	ANNUAL	No	
MM60	8	ANNUAL	Yes	
MM62	4	ANNUAL	Yes	
MM63	5	ANNUAL	No	Yes
MM64 ACTIVE	Constant (>100)	ANNUAL	No	
MM68	2	ANNUAL	No	

Mound MM64 recorded constant images of a pair of Malleefowl scratching and laying (**Image 2**).

Image 2: Mound MM64 recorded as Active

Mound MM53 recorded constant images of a pair of Malleefowl scratching and laying and maintains its status as ANNUAL. This mound is inside the DE south of the airstrip and recorded two birds visiting and maintaining the mound (**Image 3**).

Image 3: Malleefowl at mound MM53

3.2.2 OTHER SPECIES

Western Brush Wallaby (**Image 4**), Goanna, Feral Cat, and Crested Dragon where all recorded visiting mounds, together with a suite of small woodland bird species. **Table 5** (**Appendix Two**) lists all species recorded visiting the trail camera monitored mounds for 2020-21.

Image 4: Western Brush Wallaby at mound MM60

3.2.3 INTRODUCED PREDATORS

Feral Cats were recorded by trail cameras (**Image 5**) at five Malleefowl mounds (MM17, MM24, MM34, MM63, and MM70). Four of these mounds (MM17, MM24, MM34, MM63) are all outside the DE to the northwest of

MM63 all recorded Malleefowl activity (**Table 3** and **Map 2**). Mound MM70 is located at the southern end of the Blue Vein haul Road.

The 2019-20 monitoring recorded Feral Cats at nine mounds indicating a reduction in the number of visits to Malleefowl mounds by Feral Cats during the 2020-21 monitoring period.

Image 5: Feral Cat recorded at mound MM63

3.3   ACITIVTY ANALYSIS

An analysis was performed using the recorded events of activity at each mound to determine areas of Malleefowl activity. Tabulated event numbers for each mound that recorded activity by Malleefowl was analysed in GIS to produce a heat map of activity based on the number of events recorded for each mound by trail camera images (**Figure 1**).

The analysis determined that there is potentially three breeding pairs of Malleefowl within the area of the monitored mounds. **Figure 1** shows that Malleefowl activity is highest around the two active mounds MM53 and MM64. The activity around mounds MM17, MM63 and MM24 is not attributed to mound building or egg laying however these mounds were visited many times and most likely by the same birds that may have an unmonitored active mound nearby.
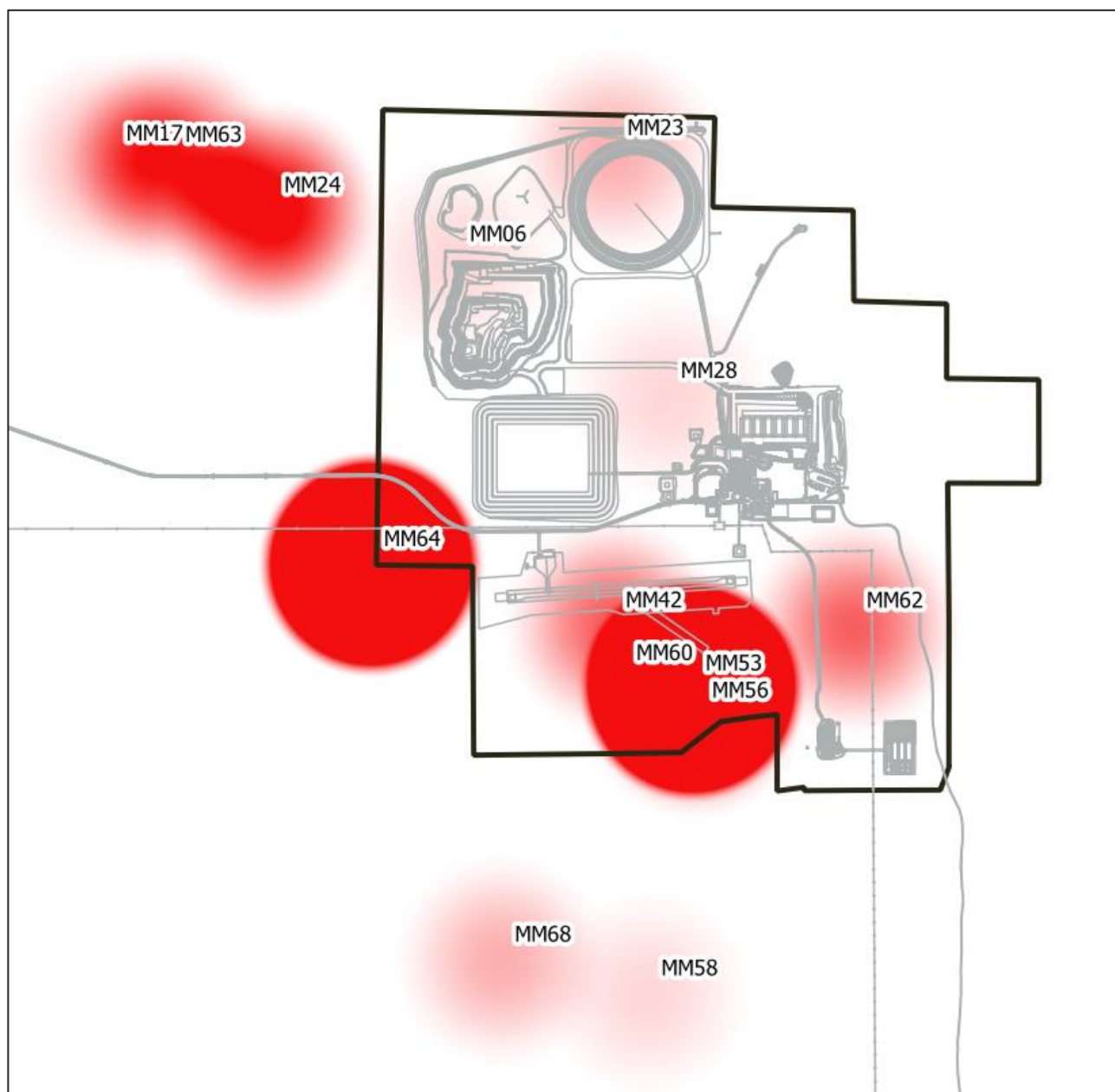
Figure 1: Malleefowl activity heat map based on number of events recorded 2020-21 at camera monitored mounds

Data for 2019-20 monitoring was subjected to the same GIS analysis to provide comparison between years (**Figure 2**). Malleefowl mound MM17 was the only mound active for the length of the 2019-20 monitoring period. Mound MM23 was recorded as active and then subsequently abandoned approximately halfway through the monitoring period, most likely due to a feral cat visit (Ecoscape 2019).

The activity pattern for 2020-21 is similar to that of 2019-20 in that Malleefowl activity was recorded around mounds located in the same areas with the exception of MM28 and MM64. The obvious difference is the increase in activity during 2020-21 and this has been supported by the increase in the number of sightings of Malleefowl being reported on site since February 2021.
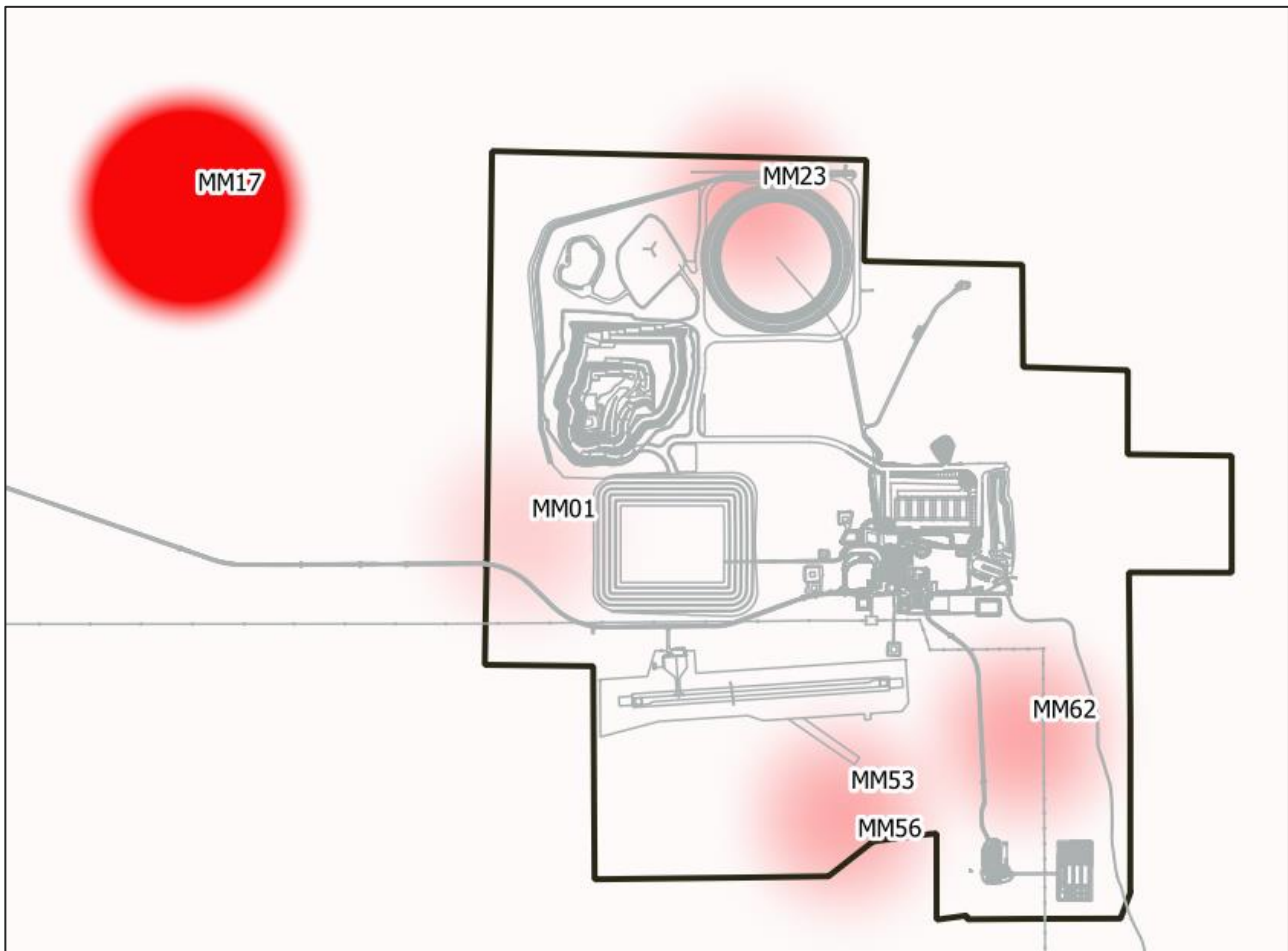
Figure 2: Malleefowl activity heat map based on number of events recorded 2019-20 at camera monitored mounds

3.4   LIDAR GROUNDTRUTHING

Ground truthing of LiDAR results was undertaken during a fauna survey along the Blue Vein Haul Road. A buffer of 200 m either side of the haul road was surveyed for habitat assessment and to confirm presence of Malleefowl within the proposed alignment.

Nine new Malleefowl mounds were identified from LiDAR results and added to the list of known Malleefowl mounds, these were measured for the first time during this 2021-22 Malleefowl monitoring period (**Map 4**). One of these new mounds recorded Malleefowl activity (MM68) and was recorded as LiDAR Class 1. The remaining eight new mounds were recorded as LiDAR Class 2 (3 mounds) and LiDAR Class 3 (5 mounds) (**Map 4**). Two other LiDAR mounds were ground truthed resulting in them being recorded as "Not a Malleefowl mound", these mounds were classed as 1 and 3, which indicates that ground truthing is necessary to determine actual Malleefowl mound presence. LiDAR class definitions are summarised as:

    Class 1 –<u>highly likely</u> to be a Malleefowl nest mound.

    Class 2 –<u>could be</u> a Malleefowl nest mound.

    Class 3 –<u>isn't very similar</u> to a typical Malleefowl mound.

    Class 4 –<u>isn't very similar</u> to a typical Malleefowl mound and less so than Class 3.

4 DISCUSSION AND RECOMMENDATIONS

4.1 MALLEEFOWL MONITORING

4.1.1 MALLEEFOWL MOUND MONITORING

Two active mounds were recorded in both 2019-20 and 2020-21. Both years recorded one active mound inside the DE and one active mound outside the DE. A total of 14 mounds recorded Malleefowl activity in 2020-21 compared to six mounds in 2019-20 indicating a substantial increase in recorded Malleefowl activity.

Figures 1 and **2** clearly show the increase in activity in 2020-21 with the two active mounds (MM64, MM53) recording mound building and egg laying behaviour constantly through the monitoring period.

The results indicate that there were two discrete breeding pairs of Malleefowl maintaining mounds during the 2020-21 monitoring period. It is likely there is also an additional breeding pair of Malleefowl active around the mounds to the northwest of the DE (mounds MM17/24/34/63) (

Map 2).

Only mounds classified as ANNUAL will be monitored in 2021-22 and mounds classified as 5 YR will be monitored in 2025. **Table 6** (**Appendix Two**) lists the 28 ANNUAL mounds that will be monitored in the 2021-22 monitoring program commencing in September 2021.

4.1.2 ACTIVITY ANALYSIS

The analysis of images to produce activity patterns at the monitored mounds and the resulting heat maps indicate three areas of high activity for 2020-21 (**Figure 1**). The activity patterns are similar when compared to 2019-20 monitoring (**Figure 2**) in that activity was centred in the northwest outside the DE and immediately south of the airstrip. Minor activity was recorded between these two areas suggesting that either there are additional Malleefowl in the area, or more likely, that the breeding birds are ranging for forage around the active mounds.

The results indicate four Malleefowl are known to be active within the monitoring area.

4.1.3 INTRODUCED PREDATORS

Over the 2020-21 period of trail camera monitoring five different mounds recorded visits by Feral Cats. Four of these mounds (MM17, MM24, MM34, MM63) are all outside the DE to the northwest of the Earl Grey and Jasmine Pits and are within 1500 m of each other. The images recorded show distinguishing stripe patterns suitable to confirm that the animal seen on trail camera images in this area are likely to be the same individual.

A single Feral Cat was recorded at mound MM70 at the southern end of the Blue Vein Haul Road.

4.2 RECOMMENDATIONS

These recommendations are made without knowledge of the possible conditions of approval and pertain to monitoring of the likely Malleefowl population within the overall project area and are aligned with the guidelines of the NMRT Monitoring Manual.

Monitoring of mounds both within and outside of the DE may provide insight on the number of birds breeding and foraging that may be impacted by potential clearing activity.

To provide Malleefowl population health and abundance data the following aspects are recommended to be monitored annually:
- Trail camera monitoring during the egg incubation season for 2021-22 (September to January) of all Malleefowl mounds that have been identified as ANNUAL, within and adjacent to the DE.
- Maintain database of Malleefowl sightings within a fauna register and report annually on number and location of active mounds.
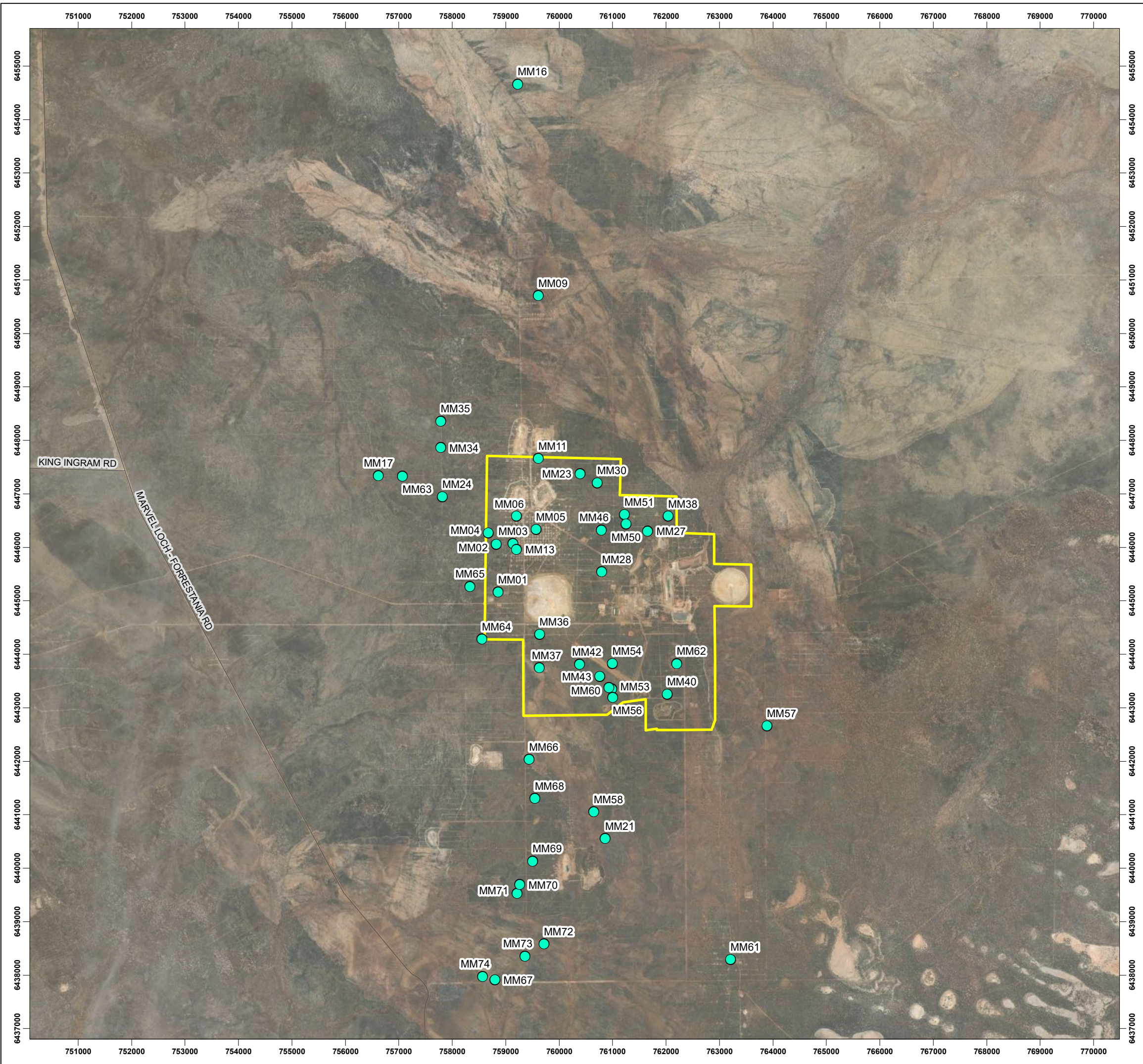
- Collate image data and report on status of all monitored mounds.
- Collate and report on records of sightings of feral predators and images captured on cameras at the monitored mounds.
- Complete ground truthing of LiDAR data within the DE.

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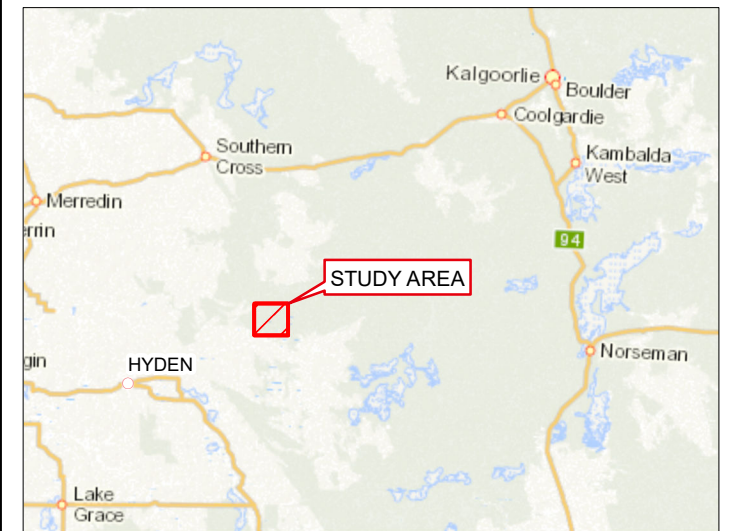
APPENDIX ONE   MAPS

STUDY AREA

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MONITORED
MALLEEFOWL MOUNDS

2020 MALLEEFOWL MONITORING

covalent
LITHIUM

SCALE: 1:70,000 @ A3

N

0   1   2   3 km

MAP

01

PROJECT NO: 4638-21

REV	AUTHOR	APPROVED	DATE
0	SB	BT	03/06/2021

STUDY AREA

ecoscape

ACTIVE MOUNDS AND RECORDED MALLEEFOWL

2020 MALLEEFOWL MONITORING

covalent
LITHIUM

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:30,000 @ A3

0   1 km

MAP

02

PROJECT NO: 4638-21

REV	AUTHOR	APPROVED	DATE
0	SB	BT	03/06/2021
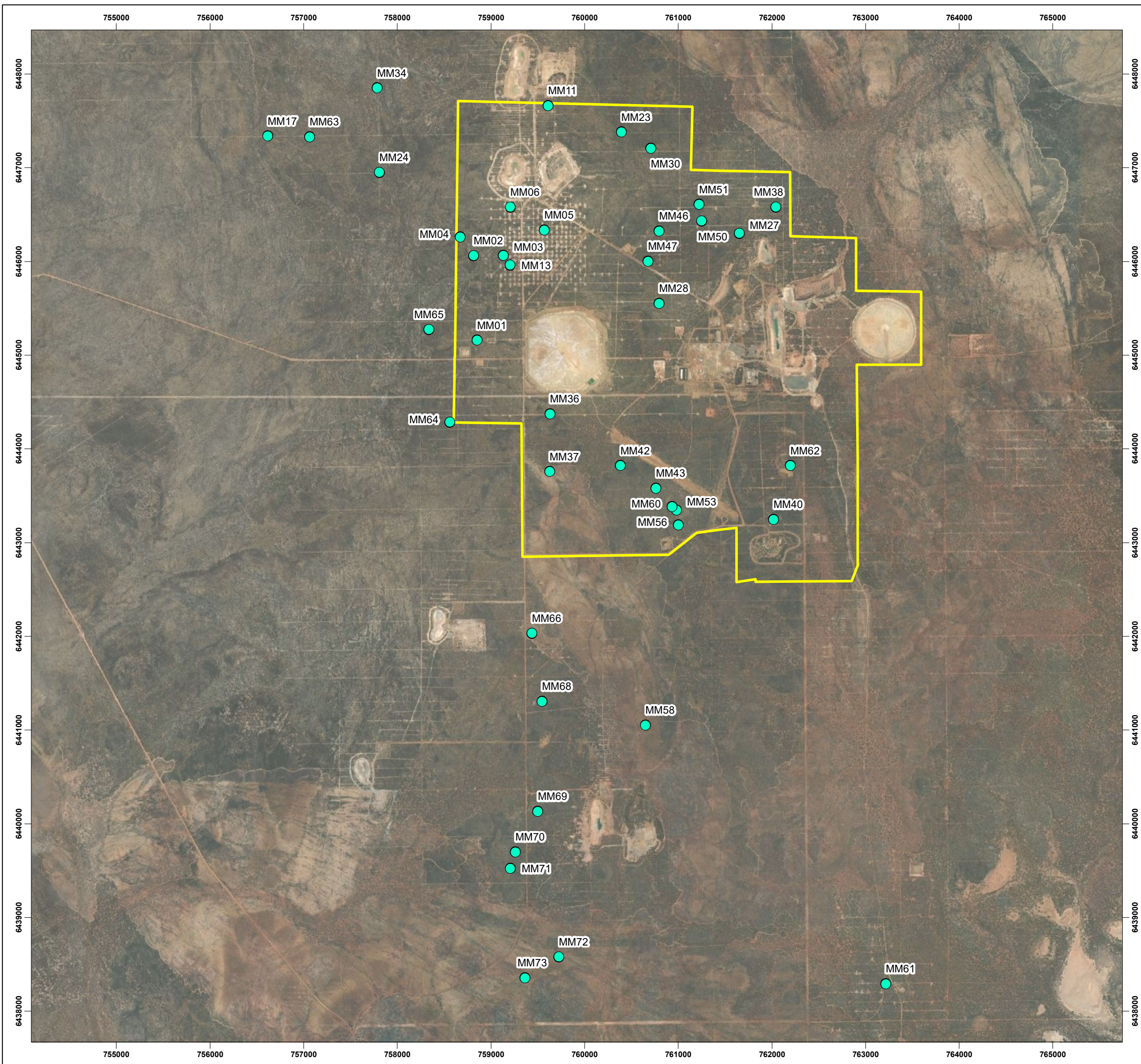
LEGEND

● Camera Monitored Mounds 2020
▢ Covalent Development Area

DATASOURCES :
SOURCE DATA:
AERIAL:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

STUDY AREA

ecoscape
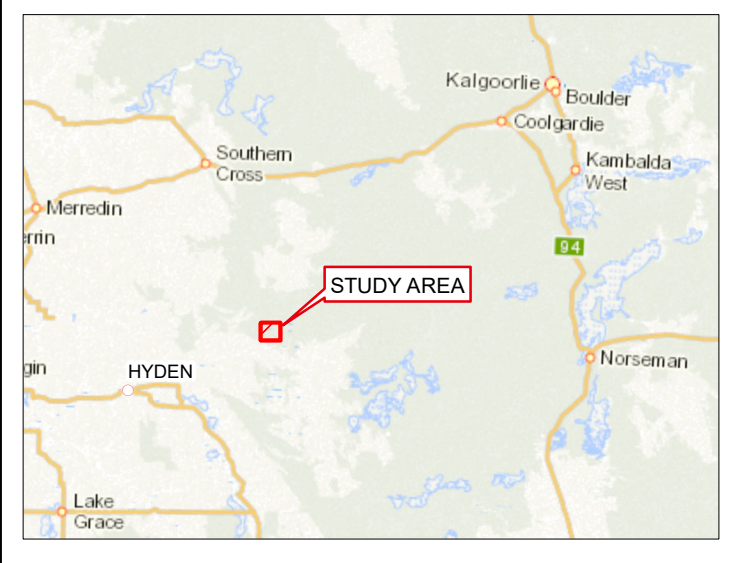
MALLEEFOWL MOUNDS
MONITORED BY CAMERA
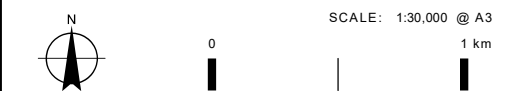
2020 MALLEEFOWL MONITORING

covalent
LITHIUM

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:40,000 @ A3

0   1 km

N

MAP

03

PROJECT NO: 4638-21

REV	AUTHOR	APPROVED	DATE
0	SB	BT	03/06/2021

LEGEND

LiDAR Mound Rating

- 🔴 1
- 🔵 2
- 🟡 3

▢ Covalent Development Area

Map labels on aerial image:
- MM66
- MM68
- MM69
- MM70
- MM71
- MM72
- MM73
- MM74
- MM67

Location inset: Kalgoorlie, Boulder, Coolgardie, Southern Cross, Kambalda West, Merredin, STUDY AREA, HYDEN, Norseman, Lake Grace

ecoscape

MALLEEFOWL MOUNDS GROUND TRUTHED FROM LIDAR DATA

2020 MALLEEFOWL MONITORING

covalent LITHIUM

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
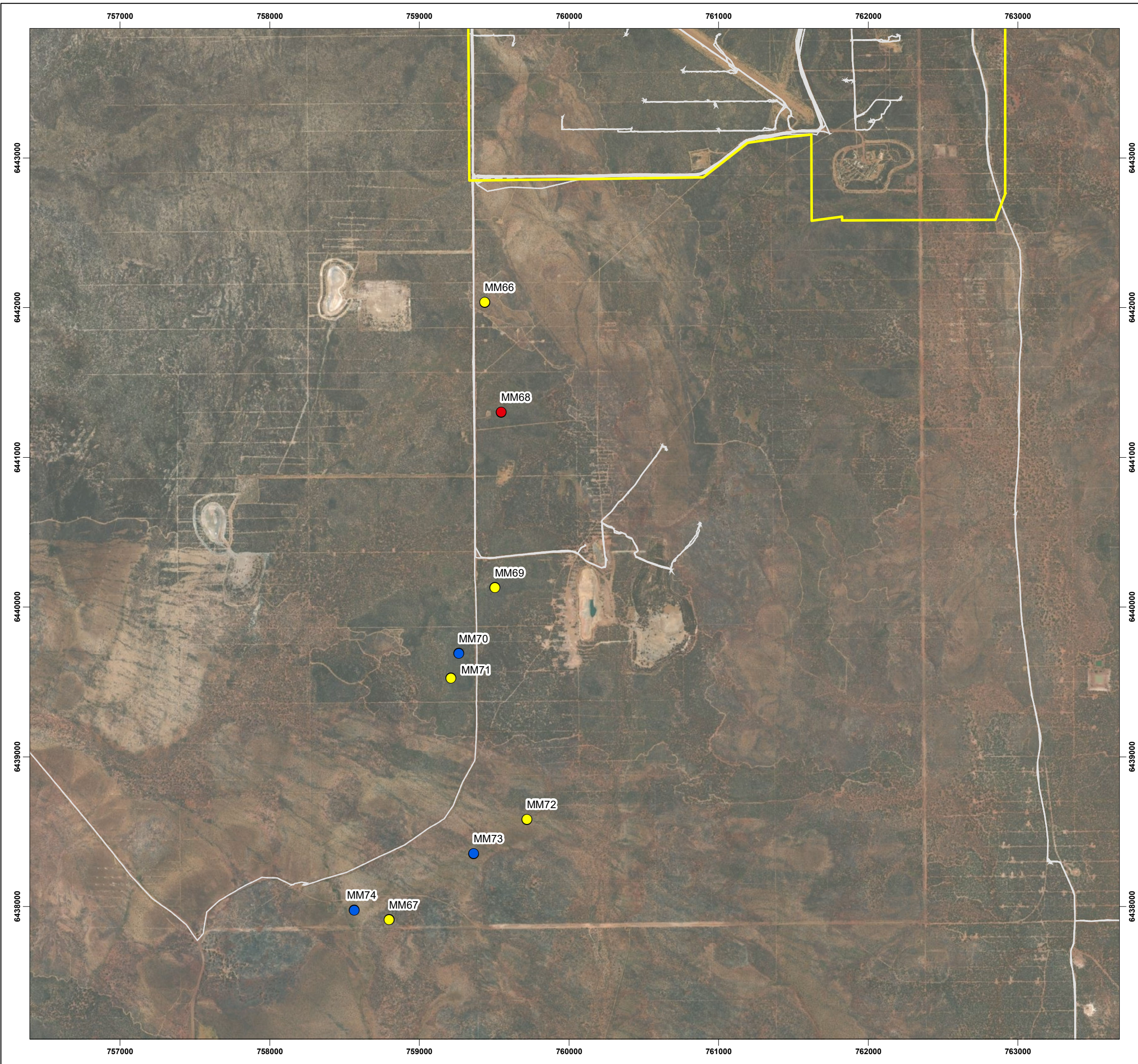PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:25,000 @ A3

0   1 km

N

MAP
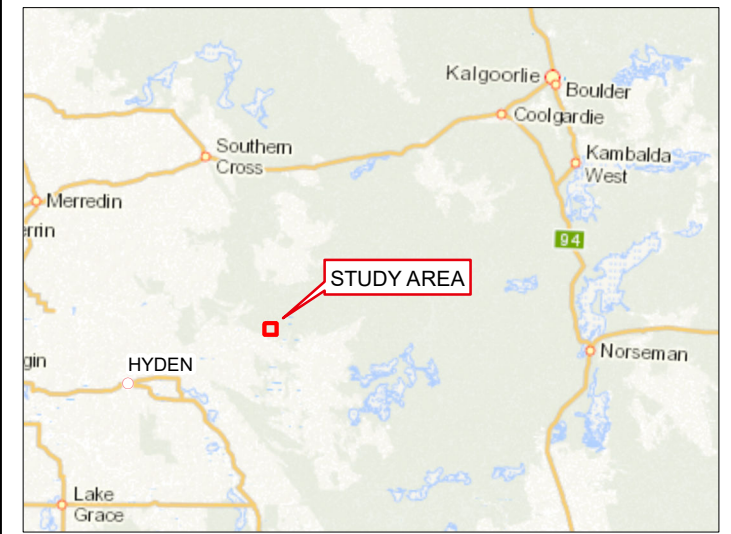
04

PROJECT NO: 4638-21

REV	AUTHOR	APPROVED	DATE
0	SB	BT	03/06/2021

APPENDIX TWO   MONITORING RESULTS

Table 4: Malleefowl mounds visited and monitored during the survey (nc denotes no camera; highlight indicates ACTIVE mound)

Mound No.	Date on	Camera No.	Easting	Northing	Action
1	16/10/2020	91	758850.460	6445161.570	5 YR
2	16/10/2020	55	758814.450	6446062.100	ANNUAL
3	15/10/2020	84	759133.710	6446066.500	ANNUAL
4	16/10/2020	54	758671.410	6446261.450	ANNUAL
5	15/10/2020	8	759571.050	6446334.560	ANNUAL
6	15/10/2020	83	759206.900	6446581.350	5 YR
9	15/10/2020	nc	759604.130	6450699.880	5 YR
11	15/10/2020	10	759608.780	6447663.710	ANNUAL
13	15/10/2020	78	759204.100	6445963.530	5 YR
16	15/10/2020	nc	759224.280	6454662.700	5 YR
17	15/10/2020	87	756616.660	6447339.360	ANNUAL
21	17/10/2020	nc	760873.700	6440549.620	ANNUAL
23	15/10/2020	4	760393.670	6447381.410	ANNUAL
24	15/10/2020	79	757807.780	6446949.680	ANNUAL
27	15/10/2020	7	761651.630	6446301.610	5 YR
28	17/10/2020	71	760796.080	6445552.200	5 YR
30	15/10/2020	11	760706.640	6447208.880	5 YR
34	15/10/2020	85	757784.400	6447850.350	ANNUAL
35	15/10/2020	nc	757782.980	6448346.610	5 YR
36	16/10/2020	89	759630.330	6444374.560	5 YR
37	16/10/2020	95	759627.840	6443759.560	ANNUAL
38	15/10/2020	6	762041.070	6446580.550	ANNUAL
40	16/10/2020	80	762018.780	6443245.980	5 YR
42	16/10/2020	96	760380.820	6443823.550	ANNUAL
43	16/10/2020	98	760762.250	6443581.310	ANNUAL
46	15/10/2020	9	760796.610	6446325.780	5 YR
47	15/10/2020	3	760678.550	6446002.240	ANNUAL
50	15/10/2020	12	761250.790	6446432.870	5 YR
51	15/10/2020	5	761222.700	6446607.560	5 YR
53	16/10/2020	97	760983.090	6443348.360	ANNUAL
54	16/10/2020	nc	761003.170	6443827.190	5 YR
56	16/10/2020	100	761001.850	6443190.010	ANNUAL
57	16/10/2020	nc	763891.580	6442652.820	ANNUAL
58	17/10/2020	56	760649.570	6441052.370	ANNUAL
60	16/10/2020	99	760934.210	6443386.150	ANNUAL
61	16/10/2020	82	763216.780	6438292.680	ANNUAL
62	16/10/2020	81	762197.180	6443821.820	ANNUAL
63	15/10/2020	86	757062.490	6447330.290	ANNUAL
64	16/10/2020	92	758558.640	6444285.370	ANNUAL
65	16/10/2020	90	758336.650	6445274.990	ANNUAL
66	17/10/2020	66	759437.293	6442033.674	ANNUAL

Mound No.	Date on	Camera No.	Easting	Northing	Action
67	17/10/2020	nc	758802.332	6437909.483	5 YR
68	17/10/2020	64	759545.240	6441306.261	ANNUAL
69	17/10/2020	58	759500.117	6440132.208	5 YR
70	17/10/2020	57	759262.392	6439696.610	ANNUAL
71	17/10/2020	60	759207.968	6439524.882	5 YR
72	17/10/2020	62	759724.731	6438579.488	5 YR
73	17/10/2020	61	759363.117	6438355.697	ANNUAL
74	17/10/2020	nc	758568.944	6437974.252	5 YR

Table 5: Species recorded by trail camera (* denotes introduced species)

Species	Common Name
Canis familiaris dingo	Dingo
Cinclosoma clarum	Western Chestnut Quail-thrush
Colluricincla harmonica	Grey Shrike-thrush
Corvus coronoides	Australian Raven
Coturnix ypsilophora	Brown Quail
Ctenophorus cristatus	Crested Dragon
Dromaius novaehollandiae	Emu
Drymodes brunneopygia	Southern Scrub Robin
Egernia richardi	Woodland Crevice Skink
Eopsaltria australis griseogularis	Western Yellow Robin
Eurostopodus argus	Spotted Nightjar
Felis catus	Cat
Gliciphila melanops	Tawny-crowned Honeyeater
Leipoa ocellata	Malleefowl
Lichenostomus cratitius	Purple-gaped Honeyeater
Lichenostomus leucotis novaenorciae	White-eared Honeyeater
Macropus fuliginosus melanops	Western Grey Kangaroo
Malurus pulcherrimus	Blue-breasted Fairy-wren
Melanodryas cucullata westralensis	Hooded Robin
Moloch horridus	Thorny Devil
Notamacropus irma	Western Brush Wallaby
Notomys mitchellii	Mitchell's Hopping Mouse
Oreoica gutturalis	Crested Bellbird
Phaps chalcoptera	Common Bronzewing
Phaps elegans	Brush Bronzewing
Pogona minor minor	Western Bearded Dragon
Pomatostomus superciliosus	White-browed Babbler
Pseudonaja affinis	Dugite
Purnella albifrons	White-fronted Honeyeater

Species	Common Name
Strepera versicolor plumbea	Grey Currawong
Tiliqua occipitalis	Western Bluetongue
Varanus gouldii	Sand Goanna
Varanus rosenbergi	Heath Goanna

Table 6: Malleefowl mounds for 2021-22 monitoring program

Mound No.	Date on	Camera No.	Easting	Northing	Action
2	16/10/2020	55	758814.450	6446062.100	ANNUAL
3	15/10/2020	84	759133.710	6446066.500	ANNUAL
4	16/10/2020	54	758671.410	6446261.450	ANNUAL
11	15/10/2020	10	759608.780	6447663.710	ANNUAL
17	15/10/2020	87	756616.660	6447339.360	ANNUAL
21	17/10/2020	nc	760873.700	6440549.620	ANNUAL
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38	15/10/2020	6	762041.070	6446580.550	ANNUAL
42	16/10/2020	96	760380.820	6443823.550	ANNUAL
43	16/10/2020	98	760762.250	6443581.310	ANNUAL
47	15/10/2020	3	760678.550	6446002.240	ANNUAL
53	16/10/2020	97	760983.090	6443348.360	ANNUAL
56	16/10/2020	100	761001.850	6443190.010	ANNUAL
57	16/10/2020	nc	763891.580	6442652.820	ANNUAL
58	17/10/2020	56	760649.570	6441052.370	ANNUAL
60	16/10/2020	99	760934.210	6443386.150	ANNUAL
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66	17/10/2020	66	759437.293	6442033.674	ANNUAL
68	17/10/2020	64	759545.240	6441306.261	ANNUAL
70	17/10/2020	57	759262.392	6439696.610	ANNUAL
73	17/10/2020	61	759363.117	6438355.697	ANNUAL

APPENDIX THREE   DBCA WILDLIFE LICENCES

Department of **Biodiversity,**
Conservation and Attractions

GOVERNMENT OF
WESTERN AUSTRALIA

FAUNA TAKING (BIOLOGICAL ASSESSMENT) LICENCE

Regulation 27, Biodiversity Conservation Regulations 2018

Licence Number: BA27000085-3

Licence Holder: Mr Bruce George Turner
                    Ecoscape
                    9 Stirling Highway
                    North Fremantle WA   6159

Date of Issue: 05/06/2020

Date Valid From: 23/07/2020
Date of Expiry: 22/07/2021

LICENSED ACTIVITIES

Subject to the terms and conditions on this licence, the licence holder may –

1. Take and disturb fauna (capture using cage traps, with bait loops to keep bait off the ground, universal bait with sardines, over a period of seven nights) for the purpose of environmental impact assessment. Captured fauna may have measurements and condition details recorded (including body weight, hind foot length, sex and reproductive condition), be marked (using microchip, by veterinary endorsed or suitably qualified, trained and experienced personnel) and have a tissue sample taken (ear clip/notch) prior to release at capture site. All captured vertebrate fauna will be identified to species and released immediately at capture site. Potential disturbance of fauna during non-capture methods Monitoring of Malleefowl mounds using remote sensing cameras.

LOCATIONS

1. Mt Holland Earl Grey Lithium Project 110 km south-east of Southern Cross, Shire of Yilgarn, and Jilbadji Nature Reserve, Wheatbelt Region.

AUTHORISED PERSONS

The following persons or persons of the specified class may assist in carrying out the licensed activities:

1. Hugh Christopher Osborn

CONDITIONS

1. Fauna must not be taken on CALM land, (as defined in the Conservation and Land Management Regulations 2002), unless authorised by a written notice of a lawful authority issued under regulations 4 and 8 of the Conservation and Land Management Regulations 2002.

2. If persons, other than the licence holder, are authorised to carry out/assist in carrying out the activities under the licence, the licence holder must ensure those persons have read and understand the licence terms and conditions.

3. The written authorisation of the person in possession or occupation of the land accessed and upon which fauna is taken, as required under regulation 101(2) and referred to in "Additional information" below, must:

1

Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF
WESTERN AUSTRALIA

AUTHORISATION TO TAKE OR DISTURB THREATENED SPECIES

Section 40 of the Biodiversity Conservation Act 2016

AUTHORISATION DETAILS

Authorisation type: Fauna

Authorisation number: TFA 2020-0070

Authorisation duration: From date signed by Minister's delegate, below, until 31 July 2021.

AUTHORISATION HOLDER

Bruce George Turner

Ecoscape

9 Stirling Highway

North Fremantle WA 6159

AREA TO WHICH THIS AUTHORISATION APPLIES

Mt Holland Earl Grey Lithium Project, 110 km south-east of Southern Cross, Shire of Yilgarn, Jilbadji Nature Reserve (Wheatbelt Region).

AUTHORISED ACTIVITY

Purpose of taking/disturbance:

Targeted annual chuditch survey, for population monitoring of the species, within the mine project area and nature reserve (as a control/reference site), as part of the environmental impact assessment for the mine development, construction, and operational activities.

Threatened species authorised to be taken/disturbed (including conservation status):

Chuditch, *Dasyurus geoffroii* (Vulnerable)

Quantity of threatened species authorised to be taken/disturbed:

Any number of individual animals of the above listed threatened fauna species may potentially be captured, handled and released during the trapping program and/or disturbed by the survey activities.

Authorised taking/disturbance methodology:

Annual targeted trapping program in late autumn or winter, using 60 small mammal Sheffield wire cage traps, with bait loops to keep bait off the ground (universal bait with sardines), over a period of seven nights. Captured chuditch will have measurements and condition details recorded, marked using PIT tag and DNA tissue sample taken (ear clip/notch) prior to release at capture site. All tissue samples will be lodged with DBCA. All captured vertebrate fauna will be identified to species and released immediately at capture site.

All proposed activities will be conducted in accordance with DBCA Standard Operating Procedures (SOPs) for fauna survey and monitoring techniques.

.... (Delegate's initials)

Page 1 of 3

APPENDIX FOUR   LIDAR METHOD

ANDITI

Bringing Insight to Data

COVALENT LITHIUM MALLEEFOWL MOUND DETECTION VIA LIDAR

METADATA AND METHODOLOGY REPORT

2021

COVALENT LITHIUM MALLEEFOWL MOUND DETECTION VIA LIDAR

METADATA AND METHODOLOGY REPORT

Prepared by
Anditi Pty Ltd

Project Manager: Gareth Evans
Report No.   Covalent Lithium Malleefowl Mound Detection
Date: 2021

A N D I T I

Table of Contents

1.0   Introducing Anditi Pty Ltd

Anditi Pty Ltd (Anditi) is a spatial analytics company that is focussed on providing high quality geospatial services to clients across the globe. Anditi provides Geographic Information Systems and Services including analysis and mapping. With our efficient proprietary spatial engine software we are able to tackle complex queries and problems through deep analysis of data in a way that no other GIS solutions can match.

Anditi combines more than 18 years' experience in advanced spatial analytics with the latest high-performance computing technologies. Our ingenious solutions unlock the potential of LiDAR, imagery and other spatial big data where precision, flexibility and scale make the difference.

Using cutting-edge data processing algorithms, machine learning and advanced cloud computing, Anditi provides businesses, organisations and the community with complete solutions for spatial empowerment.

Image: Urban DEM

Image: Flow Path Analysis

Image: Roof plane extraction

Image: Solar Potential Analysis

Image: Advanced Slope Algorithms

Image: Classification of LIDAR

Image: Contouring
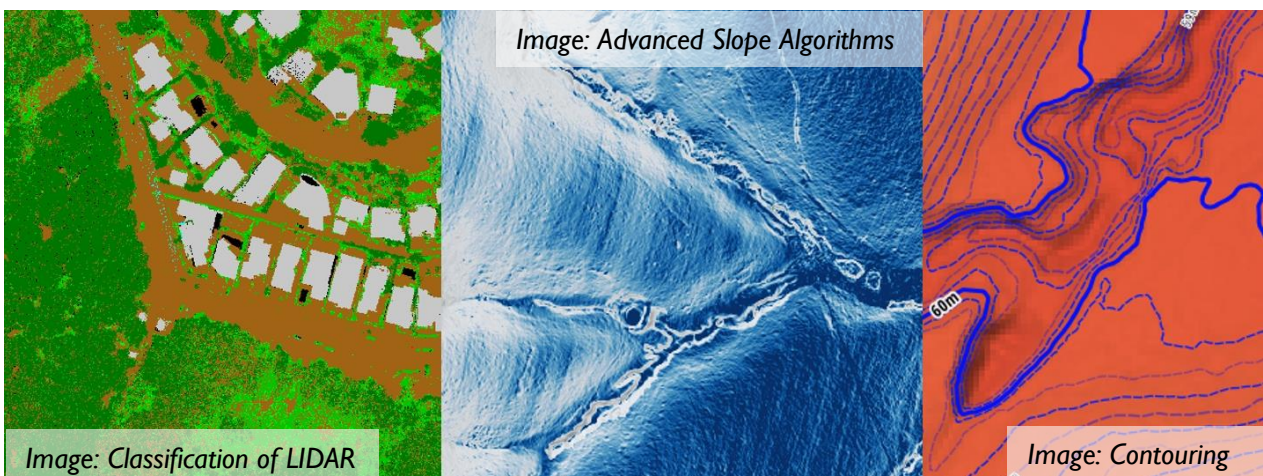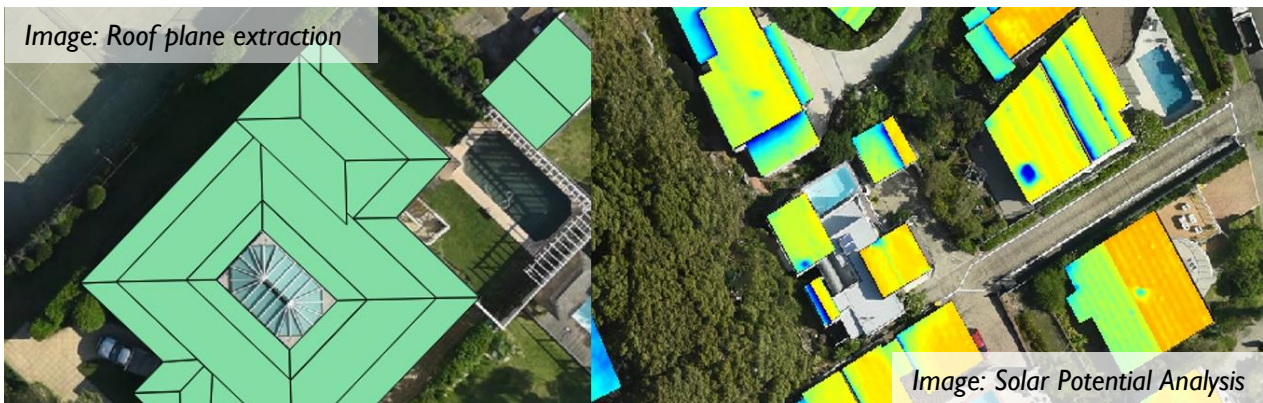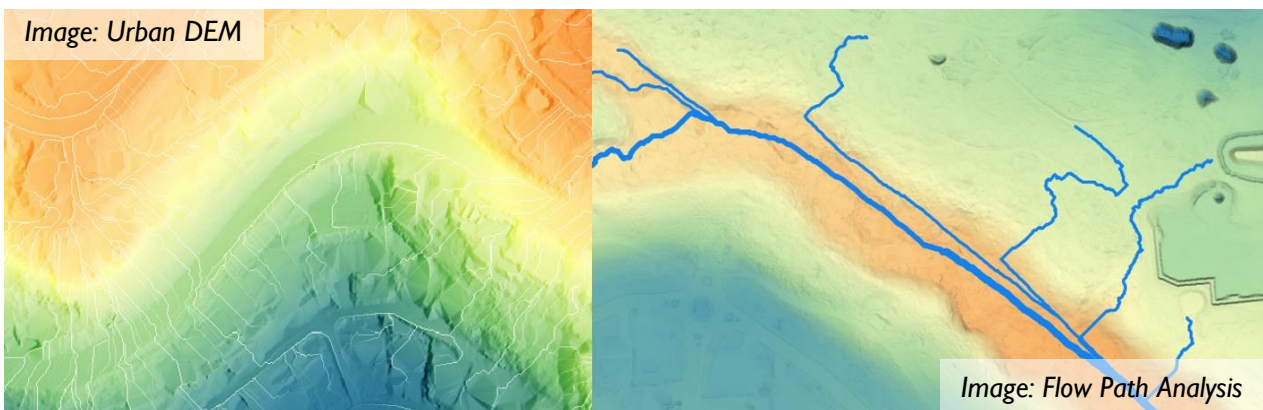
2.0 Project outline

In late 2019 MNG Survey captured Aerial LIDAR data over the Covalent Lithium area shown below. Anditi analysed the aerial laser scanning to find Malleefowl mounds through automation, with manual checking, so that field surveys could be targeted. Data for the analysis was captured and provided by MNG Survey. It consisted of aerial LiDAR at a minimum of 5 points per m².

The Aerial LIDAR Metadata can be found in the accompanying document: *Covalent Lithium 2019 Malleefowl Aerial LIDAR Survey METADATA.pdf*. The Malleefowl mound locations and rating was supplied as a separate ESRI Shapefile.
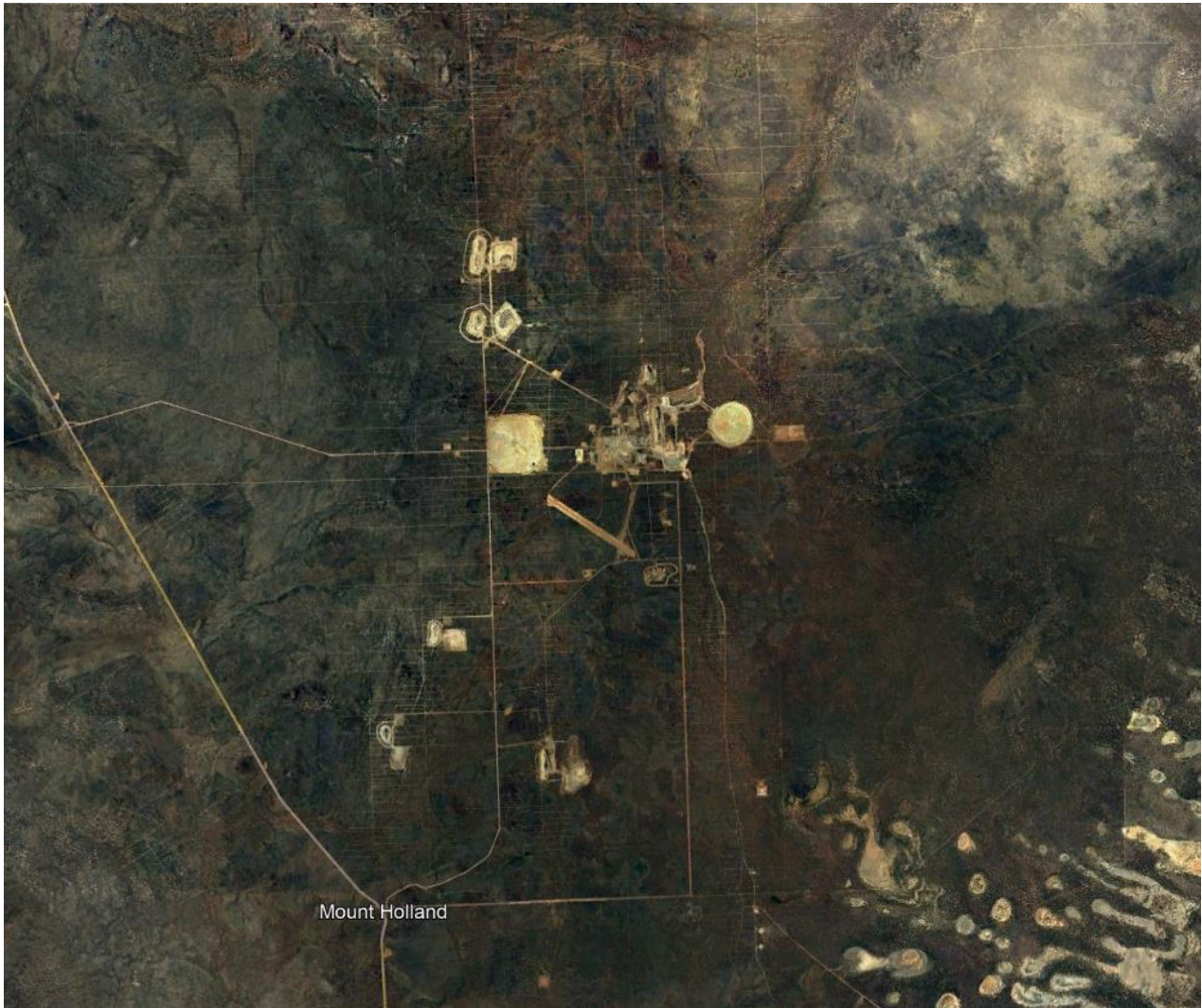
Project Location
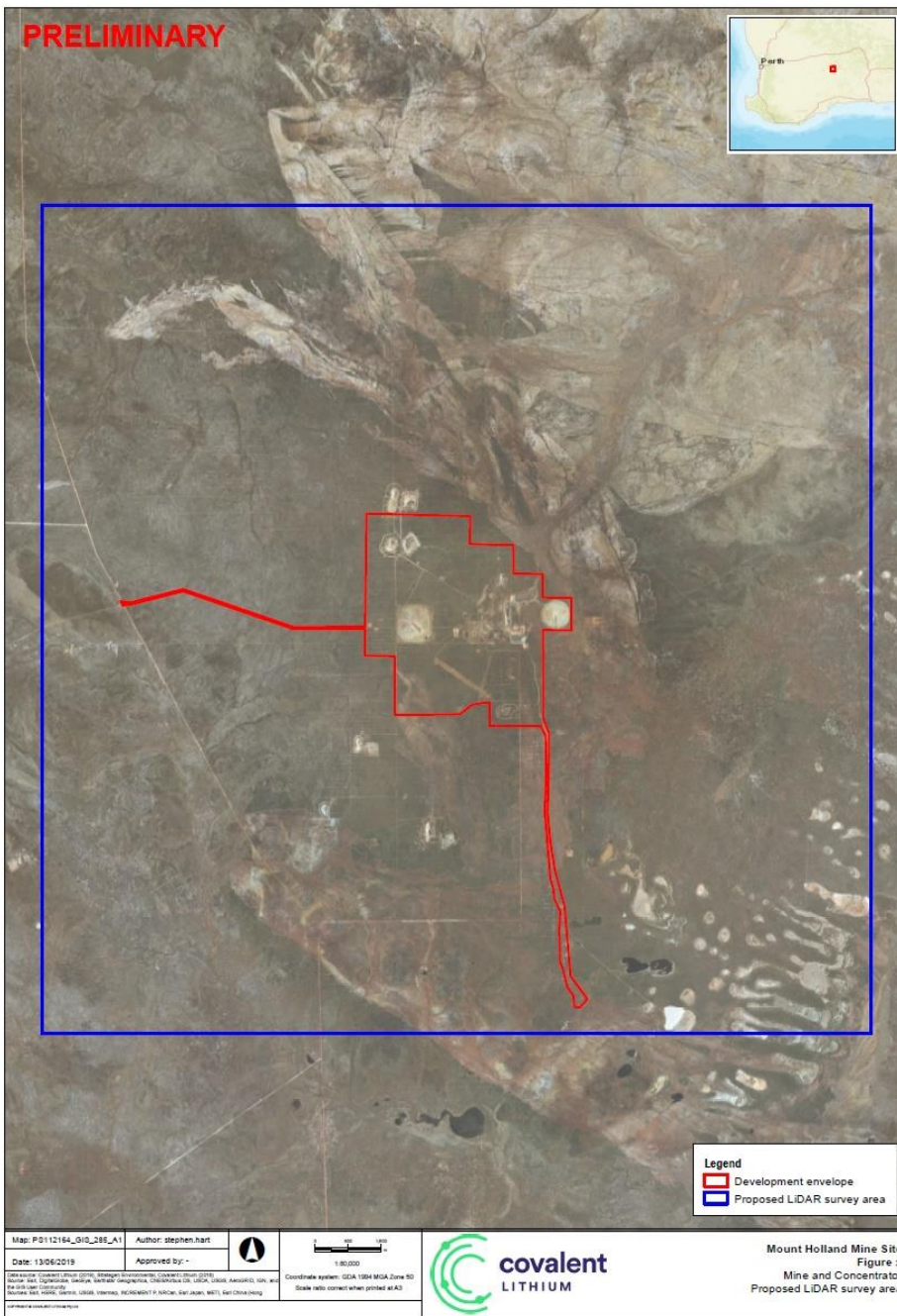
3.0 Data analysis

Review of the project area

Close to Mt Holland, this is an area with rolling terrain and relatively dense groundcover, interspersed with medium size trees.

Rating mounds

The Anditi Malleefowl mound analysis algorithms look for ground features in the point cloud that best approximate a typical Malleefowl mound shape. Based on the algorithm match to shape and manual checks, a mound is classed from 1 to 4.

1 = Very closely matches a typical Malleefowl mound shape and is highly likely to be a Malleefowl mound

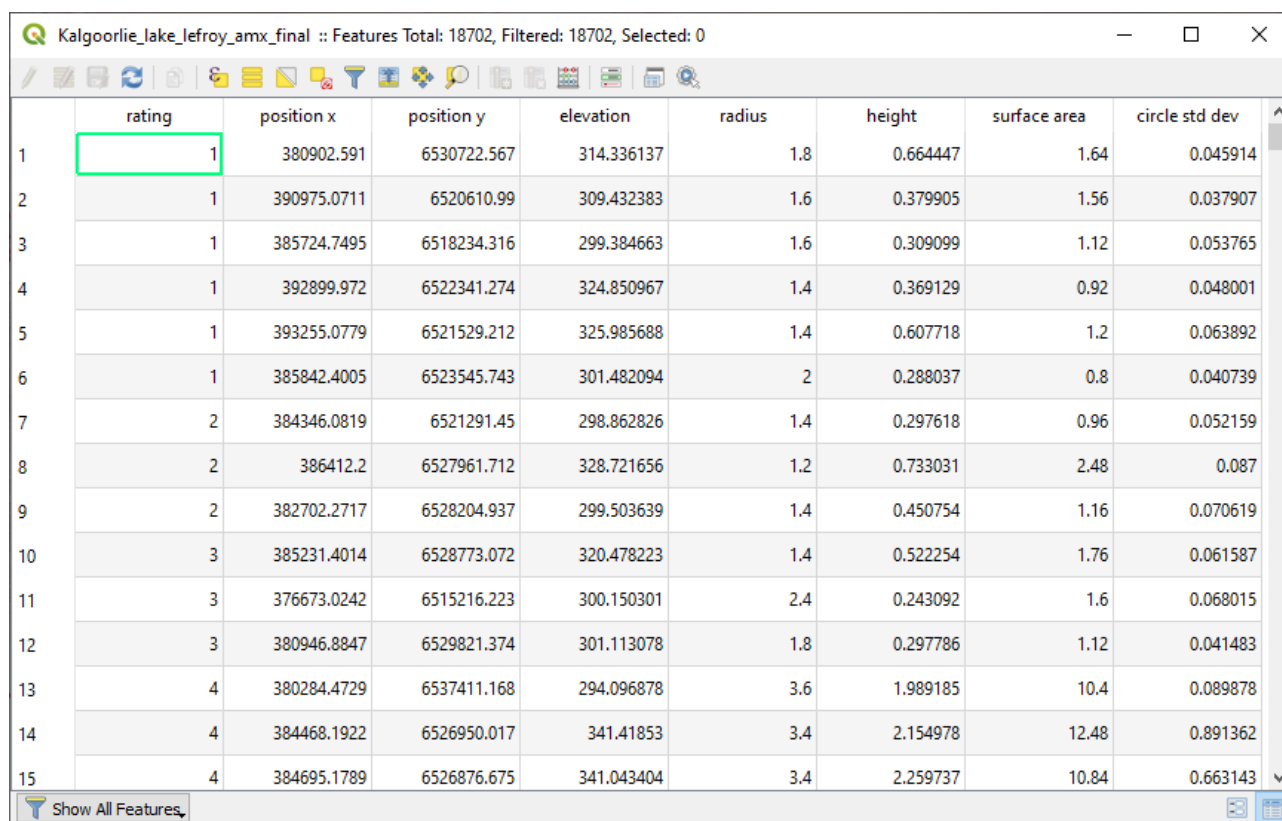2 = Is similar to a Malleefowl mound shape and could be a Malleefowl mound

3 = Is a mound shape that is approximately within the parameters of size for a Malleefowl mound but isn't very similar to a typical Malleefowl mound. This could be an old Malleefowl mound, a mound of earth around living or dead tree/vegetation, natural hummocks around waterways, etc.

4 = Is a mound shape that is approximately within the parameters of size for a Malleefowl mound but isn't very similar to a typical Malleefowl mounds. This could be a broken Malleefowl mound, a mound of earth around living or dead tree/vegetation, natural hummocks around waterways, tussock vegetation etc.

Attributes

Anditi can extract and supply a range of attributes from Rating and location to height above sea level for each mound, mound radius, mound height and more.

Data is typically supplied as a shapefile with attributes – as per the example below.

	rating	position x	position y	elevation	radius	height	surface area	circle std dev
1	1	380902.591	6530722.567	314.336137	1.8	0.664447	1.64	0.045914
2	1	390975.0711	6520610.99	309.432383	1.6	0.379905	1.56	0.037907
3	1	385724.7495	6518234.316	299.384663	1.6	0.309099	1.12	0.053765
4	1	392899.972	6522341.274	324.850967	1.4	0.369129	0.92	0.048001
5	1	393255.0779	6521529.212	325.985688	1.4	0.607718	1.2	0.063892
6	1	385842.4005	6523545.743	301.482094	2	0.288037	0.8	0.040739
7	2	384346.0819	6521291.45	298.862826	1.4	0.297618	0.96	0.052159
8	2	386412.2	6527961.712	328.721656	1.2	0.733031	2.48	0.087
9	2	382702.2717	6528204.937	299.503639	1.4	0.450754	1.16	0.070619
10	3	385231.4014	6528773.072	320.478223	1.4	0.522254	1.76	0.061587
11	3	376673.0242	6515216.223	300.150301	2.4	0.243092	1.6	0.068015
12	3	380946.8847	6529821.374	301.113078	1.8	0.297786	1.12	0.041483
13	4	380284.4729	6537411.168	294.096878	3.6	1.989185	10.4	0.089878
14	4	384468.1922	6526950.017	341.41853	3.4	2.154978	12.48	0.891362
15	4	384695.1789	6526876.675	341.043404	3.4	2.259737	10.84	0.663143

Image: example shapefile attributes

3.1   Data Received

All LIDAR data received undergoes quality checks to ensure that any major issues that would prevent a result being produced are notified to the data provider at the earliest stage. This reduces delays and additional costs.

- Swath alignment must be excellent in XYZ (no "steps" should appear in the data between flight runs).

- Point density must match the original specification for the project

- Image ground surface distance (GSD) must match the original specification for the project, the image should be clear and have no patches so dark that features are obscured and no distortion so large that features are obscured. The image should cover the entire area of interest.

- The LIDAR point data must be free of any excessive noise above, below or penetrating the ground

- There should be no obvious data gaps and the data should cover the entire area of interest

3.2   Data Load and Process

Once the data has been checked, the point cloud is loaded into the Anditi Engine, the proprietary software developed by Anditi data scientists for smart point cloud and image processing. The ground is defined through classification algorithms and then the Anditi Malleefowl mound detection algorithms are applied to the ground surface.
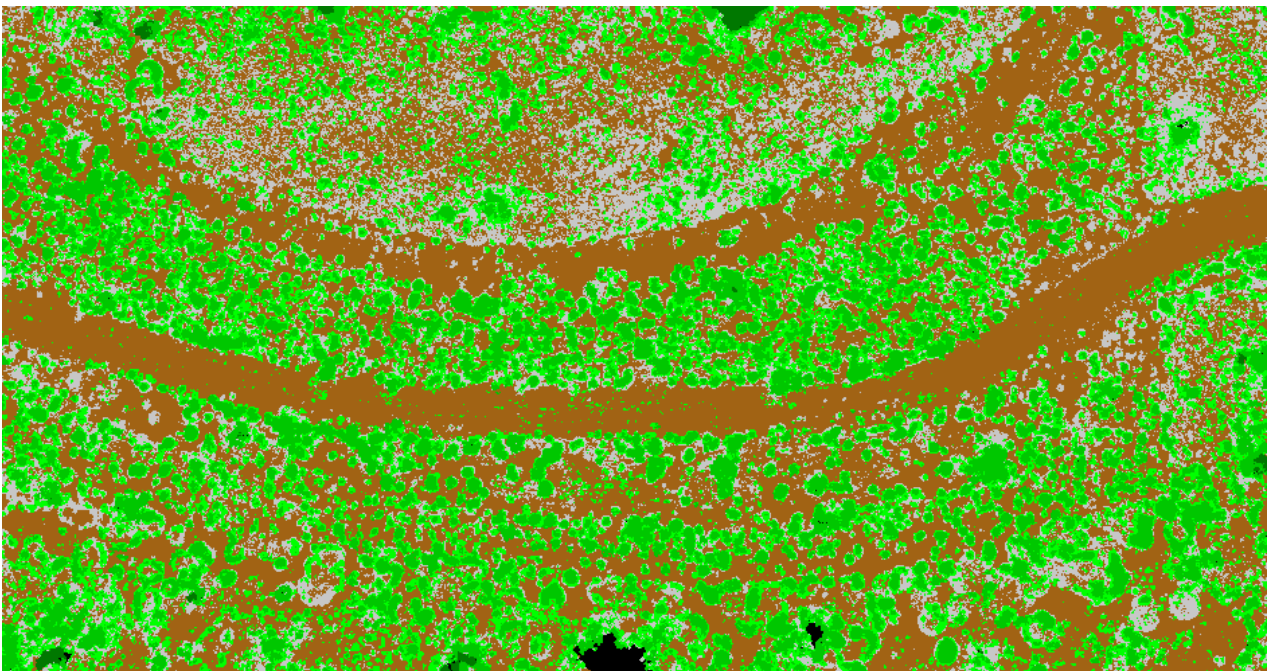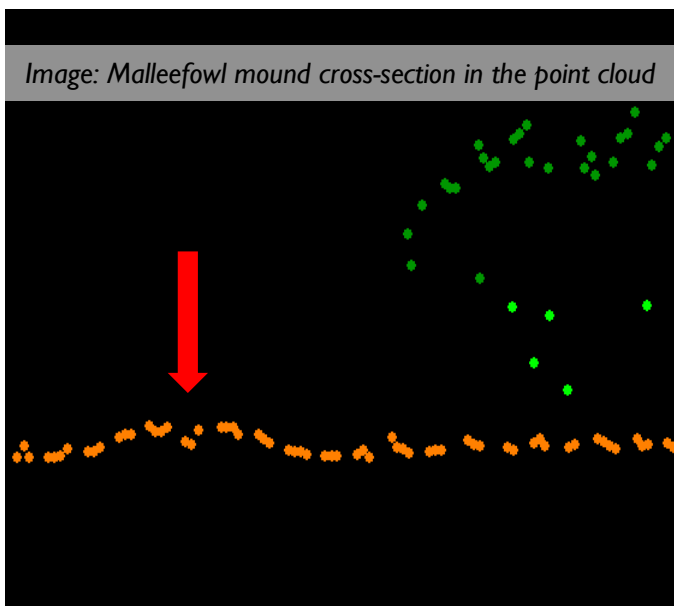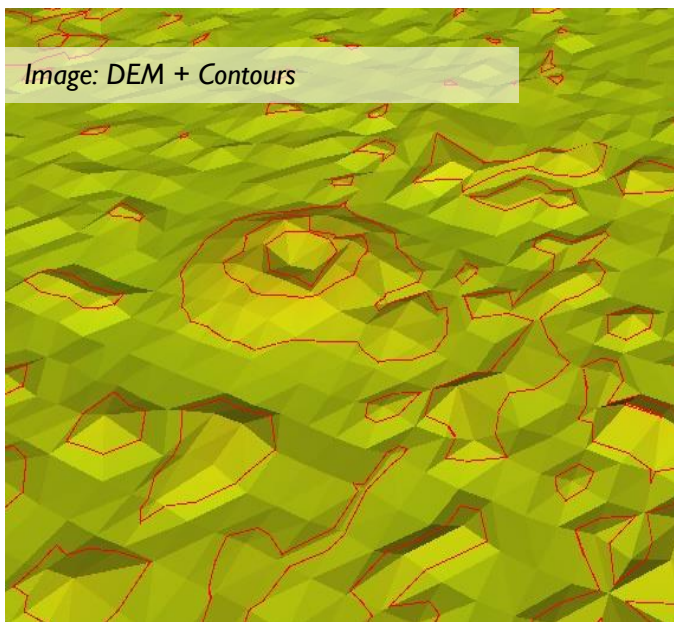

Image: Ground / non-Ground classification

3.3   Automated analysis

All mound shapes that fall within certain parameters are ranked automatically from highest potential to lowest potential by the software. A database is created, and the mounds then undergo a manual rating procedure.

A digital elevation model (DEM) is created and contoured to highlight ground features

This is overlaid with the 3D LIDAR point cloud in the Anditi Editor so that manaul editors can review the data from all angles. In some cases, the point cloud is coloured from the RGB colour orthophoto. All of these options enhance the quality of the resulting rated mounds, removing vegetation and other false positives.

Image: DEM + Contours

Image: Orthophoto of Malleefowl mound

Image: Malleefowl mound cross-section in the point cloud

3.4 Data checking procedures

3.4.1 Manual checking

Manual checking is usually completed using the Anditi point cloud reviewing tools.

We use the following criteria for category 1 mounds:

- The mound should be fairly circular in shape and look like a classic Malleefowl mound shape.

- Contours displayed on the mound should be concentric.

- There must not be any obvious human activity, like digging, water dams, road clearing, close to the mound.

- There must not be a tree originating from the mound.

- The mound should not be on a very steep surface. Normally mounds are found on flat surface, however at times in the past we have found mounds on ground with a gentle slope.

Classes reviewed

All Class 1 and 2, and some Class 3 mounds, were checked manually using all available methods and where false positives were detected, these were moved to Class 4.

No data is currently deleted, mounds that are not considered Class 1, 2 or 3 are moved to Class 4. This may be reviewed in the future.

MNG STRATUS AERIAL LASER SCANNING SYSTEM

METADATA REPORT *2311/2021*

PROJECT: *Mt Holland Mine Site*
MNG REFERENCE: *102365*
CLIENT: *Covalent Lithium*
MNG PROJECT MANAGER: *Colin Lyons*
CLIENT CONTACT: *David Bryden*
LOCATION: *Mount Holland Mine site – W.A.*
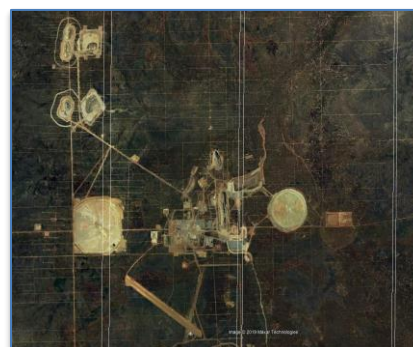
DATA CAPTURE

DATE: *July / August 2019*

ORGANISATION: McMullen Nolan Group Pty Ltd

SCAN DATA ACCURACY:
Relative: +/-0.05m (height) – 1 sigma
Absolute: +/-0.3m (height) – 1 sigma

PURPOSE: *Malleefowl Mound Indentification*

DELIVERABLES: Relative Classified Point Cloud

SYSTEMS

SCANNER: Reigl VZ2000
IMU: Novatel MicroIRS
GPS: Novatel
AIRCRAFT: Cessna 182RG

PROCESSING/DATA

PROCESSING SOFTWARE: MNG Nimbus
EXTRACTION SOFTWARE: TopoDOT, Bentley
Microstation, Magnet, Global Mapper, TerraSolid

CONTROL/VERIFICATION
Point cloud is tied to local ground control through GNSS base stations. This dataset is uncontrolled for the purposes of Malleefowl mound identification
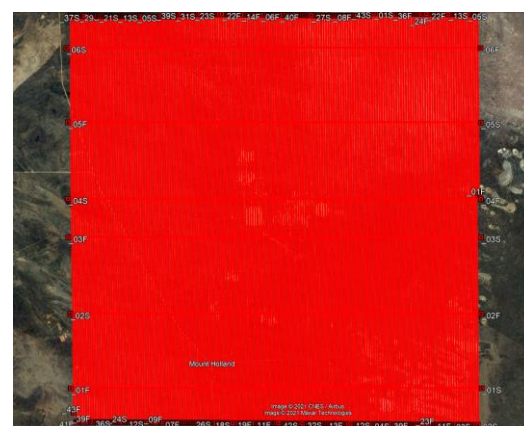
PROJECTION / DATUM
HORIZONTAL DATUM: *GDA94*
VERTICAL DATUM: *AHD*
PROJECTION: *MGA50*

CAPTURE AND POINT CLOUD SPECIFICATIONS
LINE SPACING: 120m
AGL CAPTURE HEIGHT: 880-1150ft AGL
TARGET POINT DENISTY: 5 points per square metre (minimum)

MNG.

LIMITATIONS OF DATA

- The definition of the ground under trees may be less accurate.

- Ground definition is through computer algorithm with limited manual checking. In some cases small non-ground features may remain in the dataset or small ground features may be removed.

- Landform is defined by filtered subset of the dense laser scan points. No manual breaklines are defined.

- Buildings are removed from the ground data but building outlines are not captured or used as breaklines - so contours pass through existing buildings.

CONDITIONS OF SUPPLY

This is provided by McMullen Nolan Group Pty Ltd (MNG) subject to the following conditions:
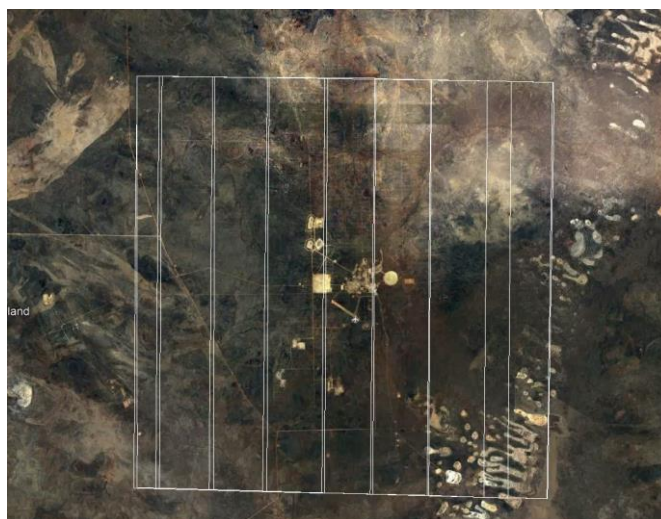
1. This file (*102365doc-004a_META.PDF*) is always stored with the unaltered data contained in this volume.

2. The data is not altered in any way without the approval of MNG.

3. The data is not used for purposes beyond that explicitly agreed in the description of the Services provided by MNG.

Any breach of these conditions will result in the immediate termination of the license issued by MNG, and the *Covalent Lithium* will indemnify MNG from all resulting liabilities.

Any problems associated with the information in this data should be reported to:

 McMullen Nolan Group Pty Ltd (MNG)

VERIFICATION PLOT:

MNG.

ANDITI

Bringing Insight to Data