



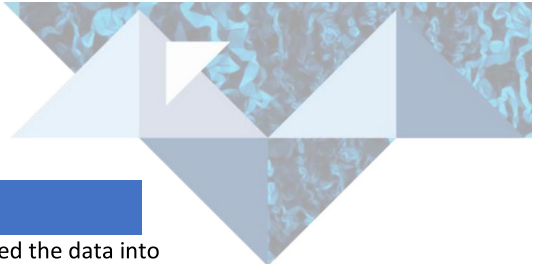
## REPORT: Black Flag KRRE Malleefowl Mound Analysis from LIDAR

**Date:** 20 June 2025

### PROJECT AREA

This is an extension to the KCGM project area of 160km<sup>2</sup> - shown in Green. This area adds 32km<sup>2</sup> across 3 separate areas – as shown in Red. This is a complex area for analysis as much of the area appears to have seen human activity. This area is directly adjacent to, and to the North East of, the Kalgoorlie-Boulder Town.

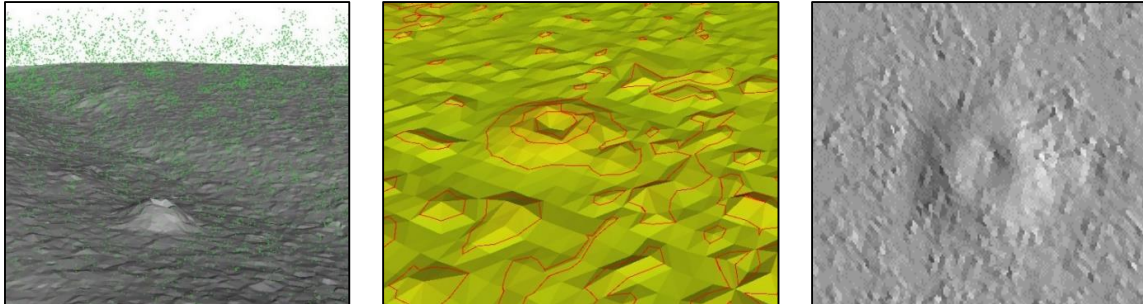




## DATA ANALYSIS

Utilising the LiDAR data and the Anditi data processing engine, Anditi classified the data into ground, vegetation and other non-ground classifications creating an accurate DEM that includes potential mound-like features. The data was then further analysed to identify Malleefowl mounds. These were found using Anditi's patented near-ground feature detection algorithms to identify potential sites, which are then ranked depending on the degree of certainty. Certainty is affected by the intactness of the mound, any overly dense obscuring vegetation and other factors, including the data gaps and general data variability.

While Anditi performed much of this automatically, some time was allowed for manual checks to ensure a high level of accuracy. Some manual checks compared ratings 1-3 against satellite imagery to check for false positives.



## 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. 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.

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

- The following criteria for category 1 mounds are applied:
  - The mound should be 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 surfaces or on ground with a gentle slope.





An orthophoto provides an excellent final check and can often clearly show Malleefowl mounds or check for and exclude false positives such as mound-like vegetation.

## ATTRIBUTES

Anditi extracted and supplied a range of attributes: Rating (rating), Location (minx, miny), height above sea level (z) for each mound, mound radius (radius, m), mound height (height, m) and Mound ID (id).

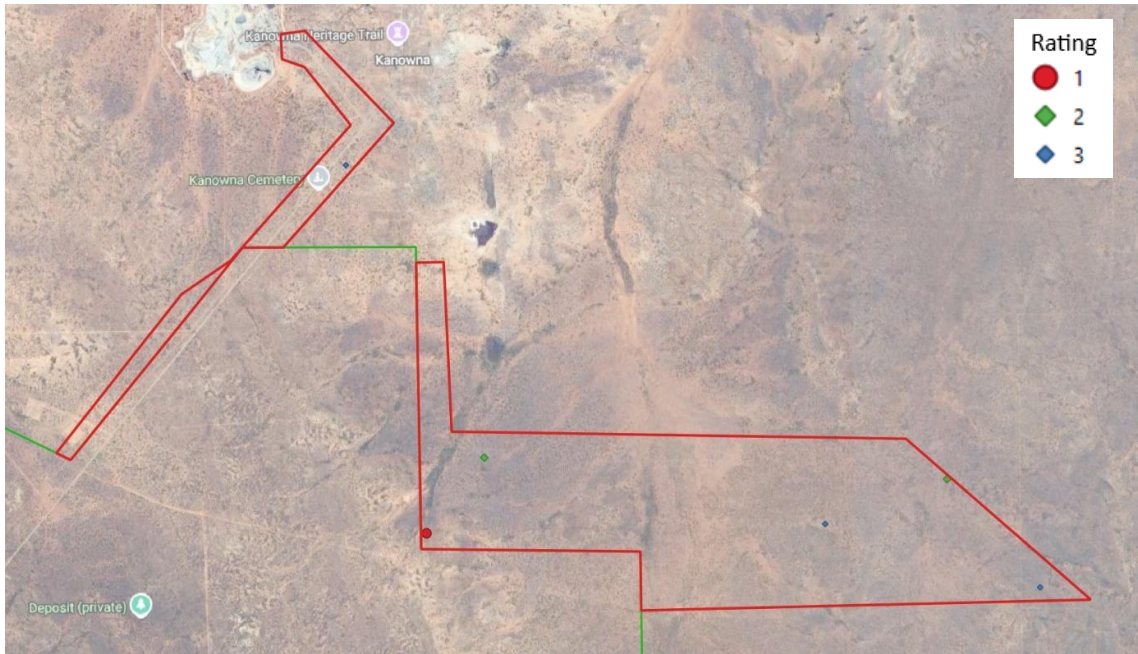
Data is supplied as a Shapefile with attributes in coordinates of MGA94, zone 51.

	id	z	minx	miny	radius	height	rating
1	3640	387.8031688300...	355461.5000000...	6598146.700000...	0.7	0.46903455	4
2	3182	386.6480458600...	355238.9000000...	6598784.099999...	0.7	0.59151106	4
3	27632	363.8430106199...	373349.5000000...	6605047.500000...	0.7	0.26681802	4
4	6380	380.3491894499...	355726.2999999...	6598653.700000...	0.7	0.59351517	4
5	24957	373.8552957800...	373364.7000000...	6603541.299999...	0.7	0.30757329	4
6	6302	380.9607028400...	355727.2999999...	6598605.900000...	0.7	0.43159873	4
7	21094	355.4547399200...	369872.9000000...	6604517.099999...	0.7	0.36041693	4
8	37993	351.7409552500...	369985.0999999...	6606112.700000...	0.7	0.38741604	4
9	78830	364.2376564699...	364798.2999999...	6610918.099999...	0.7	0.562148	4
10	3119	387.7680116199...	355302.2999999...	6598702.700000...	0.7	0.82526045	4
11	28043	373.7970672999...	374989.5000000...	6604382.900000...	0.7	0.55169293	4
12	6010	365.5286179500...	367332.0999999...	6604829.099999...	0.7	0.35402719	4
13	19363	359.2948871799...	368294.5000000...	6605971.700000...	0.7	0.51276836	4
14	10449	354.6748690900...	369234.9000000...	6605569.299999...	0.7	0.30339539	4
15	69018	352.7758814900...	371365.2999999...	6605634.900000...	0.7	0.84428133	4
16	29834	364.9536276800...	373415.2999999...	6604920.900000...	0.7	0.29983867	4
17	59996	357.1701551500...	368637.0999999...	6605537.099999...	0.7	0.30110879	4
18	40669	356.1294692899...	368896.7000000...	6605474.500000...	0.7	0.29220581	4
19	19749	360.1024740500...	372228.2999999...	6604427.099999...	0.7	0.25782829	4
20	17793	359.9111523999...	372316.7000000...	6604530.700000...	0.7	0.33534506	4
21	11220	382.3220631300...	355749.9000000...	6598077.299999...	0.7	0.52665217	4





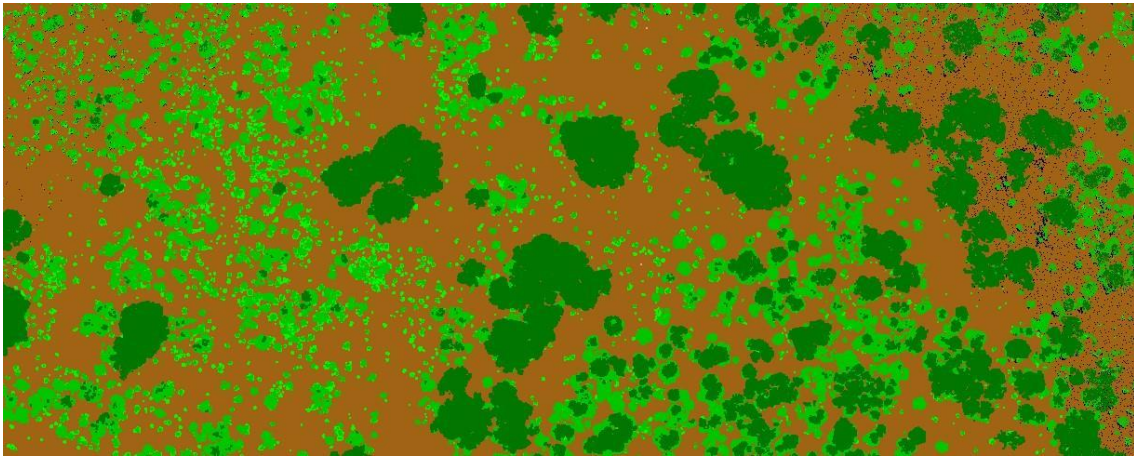
# SITE RATING OVERVIEW



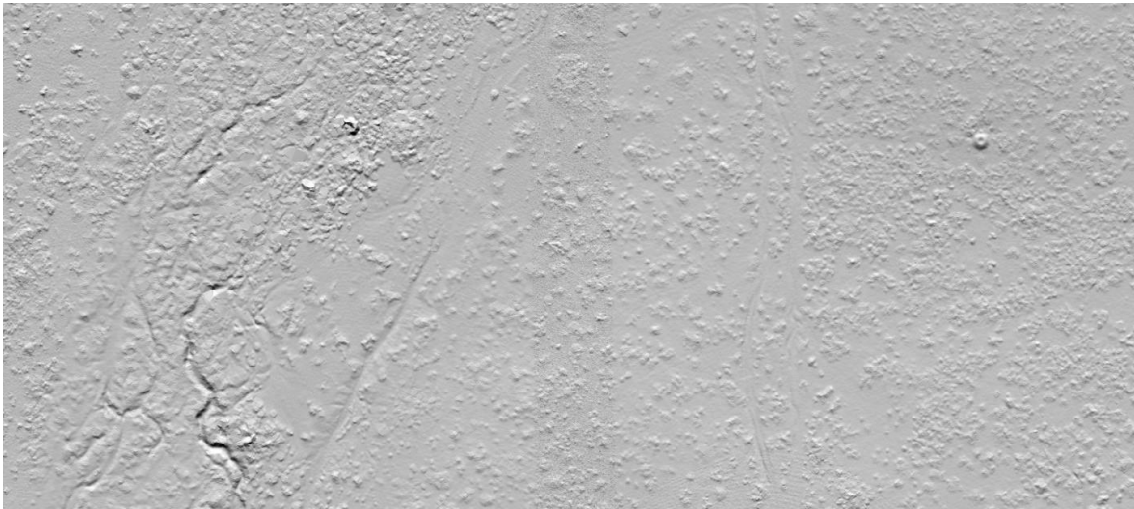


DATA

Anditi Classified Point Cloud example



Anditi Ground model example



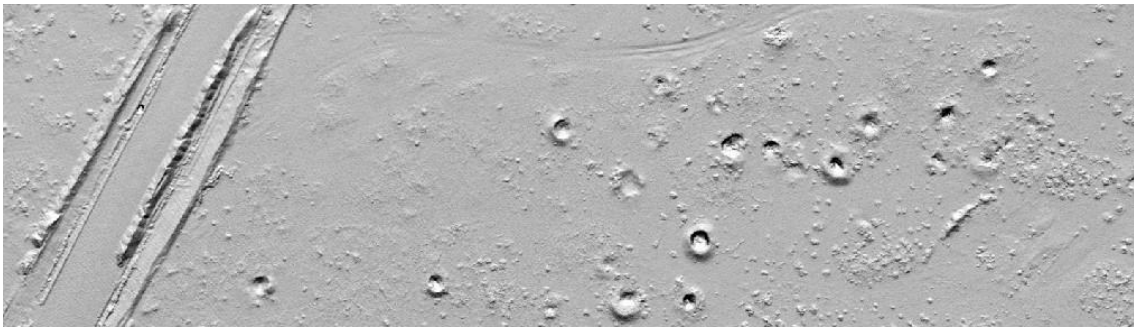
## DATA ANALYSIS RESULTS

Issues discovered in this area that impact Malleefowl mound analysis and rating accuracy.

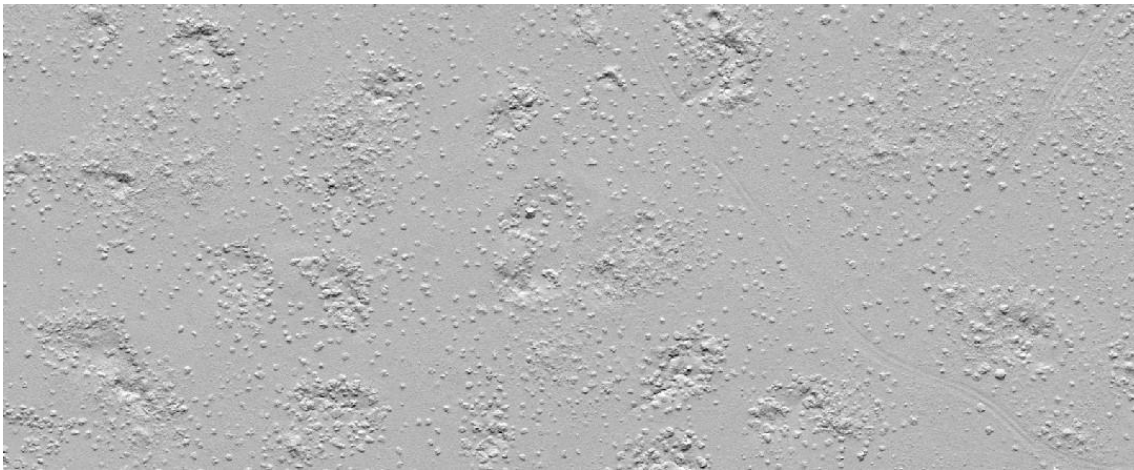
There is significant human impact on large parts of this area. This impact has created ground modification that is often very similar to Malleefowl mound earthworks or earthwork remnants. These human ground modifications take the form of conical mounds, circular mounds and ground depressions.

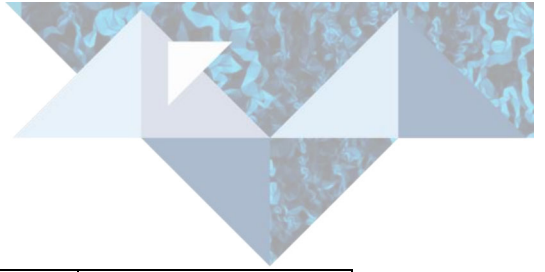
Where these features can be clearly identified as being likely to be false-positive Malleefowls mound they have been rated 4 – not likely to be a Malleefowl mound.

Malleefowl mound-like shapes. These features have the signature ground shape that defines Malleefowl mounds however they are not Malleefowl mounds.



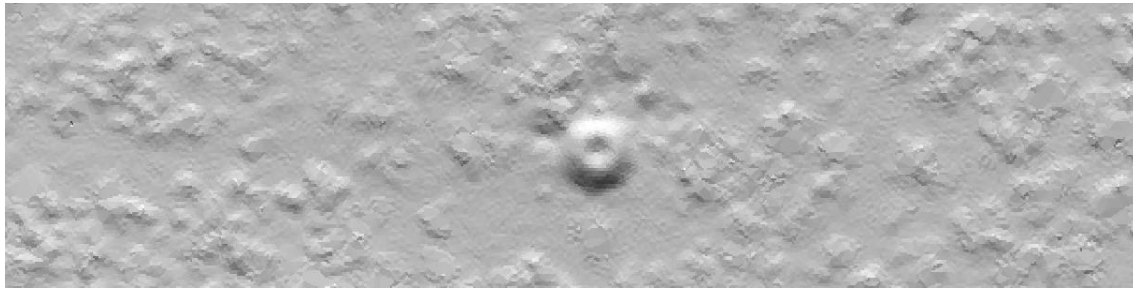
Human modified ground that has some of the characteristics that would cause the Anditi algorithms to identify these areas as being potential Malleefowl mounds. Especially where localised depression shapes occur.





Site	Rated 1	Rated 2	Rated 3
1	0	0	1
2	1	2	2
3	0	0	0

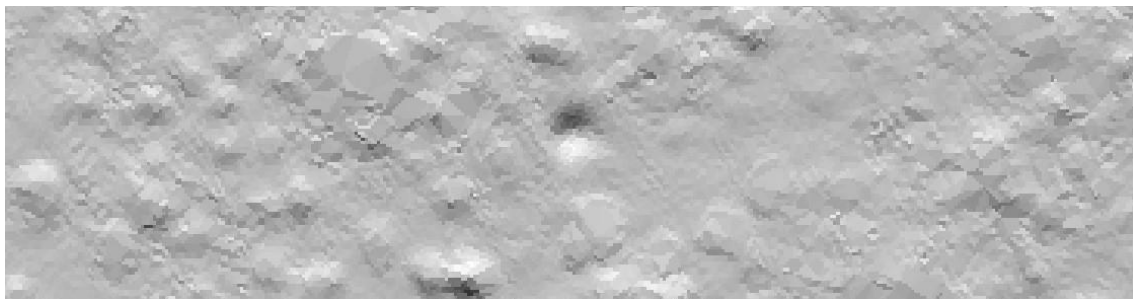
**1 Rated mounds example**



**2 Rated mounds example**



**3 Rated mounds example**





## Conclusions

There is significant terrain and vegetation variation across this site, There is extensive mining terrain modification in the North of Site 1, extensive ground modification in Site 3, and Site 2 has natural terrain and vegetation.



There are very few good candidates for actual Malleefowl mounds, and these are almost exclusively found in Site 2 where natural terrain and vegetation are prevalent.



A round of visual inspection was completed to significantly reduce the false positives rated 3. It should be noted that there may still be false-positives in this dataset as man-made features mimic the shape and size of Malleefowl nests and depressions to the extent that it is not possible to exclude these accurately from remote-sensing data (LIDAR and Imagery).





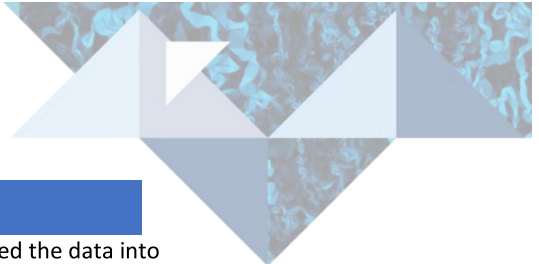
## REPORT: KCGM Malleefowl Mound Analysis from LIDAR – Revision 1

**Date:** 23 January 2024

### PROJECT AREA

The project area is 160km<sup>2</sup>. This is a complex area for analysis as much of the area appears to have seen human activity. This area is directly adjacent to the Kalgoorlie-Boulder Town and to the North East.

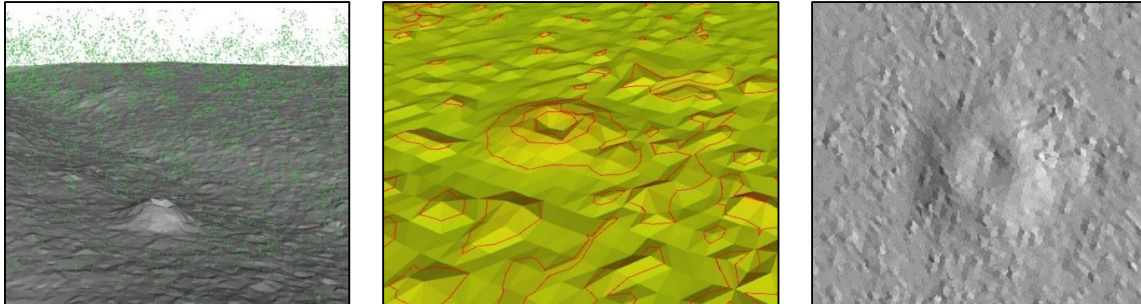




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An orthophoto provides an excellent final check and can often clearly show Malleefowl mounds or check for and exclude false positives such as mound-like vegetation.

## ATTRIBUTES

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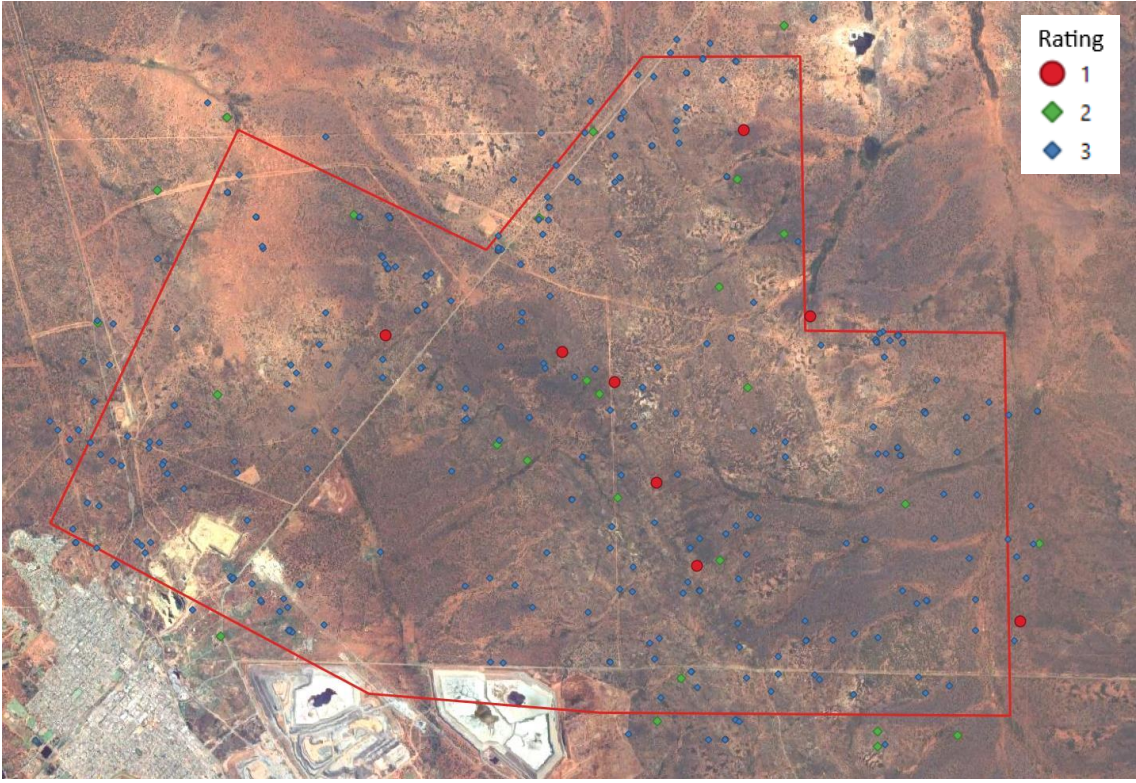
Data is supplied as a Shapefile with attributes in coordinates of MGA94, zone 51.

	id	z	minx	miny	radius	height	rating	▲
115	21420	389.5418964200...	353523.2999999...	6601502.299999...	1.600000000000...	0.9692965	3	
116	21441	388.3786112700...	353580.7000000...	6601539.700000...	0.7	0.37652048	3	
117	25657	374.1271627699...	354809.2999999...	6602482.500000...	0.7	0.26227505	3	
118	28228	362.4170882399...	355182.0999999...	6608028.099999...	0.7	0.37363858	3	
119	28783	362.9930911899...	355077.5000000...	6604951.299999...	0.7	0.28639863	3	
120	30772	363.2650270999...	355050.7000000...	6607339.099999...	0.7	0.32149993	3	
121	33970	359.9123045399...	355439.2999999...	6608532.500000...	0.7	0.42964392	3	
122	33979	360.2179616199...	355198.9000000...	6608554.700000...	0.7	0.37709931	3	
123	34024	357.4551644100...	355086.7000000...	6608808.099999...	0.7	0.29738028	3	
124	37708	360.4798287200...	355723.2999999...	6607504.099999...	0.7	0.35542847	3	
125	40200	362.5684849099...	355693.2999999...	6605071.700000...	0.7	0.33420593	3	
126	41645	361.4012950700...	355763.7000000...	6607176.700000...	1.400000000000...	0.46764495	3	
127	42338	360.3349064999...	355692.0999999...	6607443.099999...	0.7	0.41424768	3	
128	45376	360.8146214399...	356138.5000000...	6608153.900000...	0.7	0.67341993	3	
129	45706	364.4975045200...	356142.7000000...	6603701.700000...	0.7	0.50822036	3	
130	47089	362.3084364700...	356497.5000000...	6607533.900000...	0.7	0.36094924	3	
131	48124	362.0950009000...	356041.9000000...	6606675.099999...	0.7	0.3621545	3	
132	48599	362.4029589699...	356147.0999999...	6606045.700000...	0.7	0.3517465	3	
133	48627	362.3776248600...	356117.7000000...	6606085.900000...	0.7	0.26184872	3	





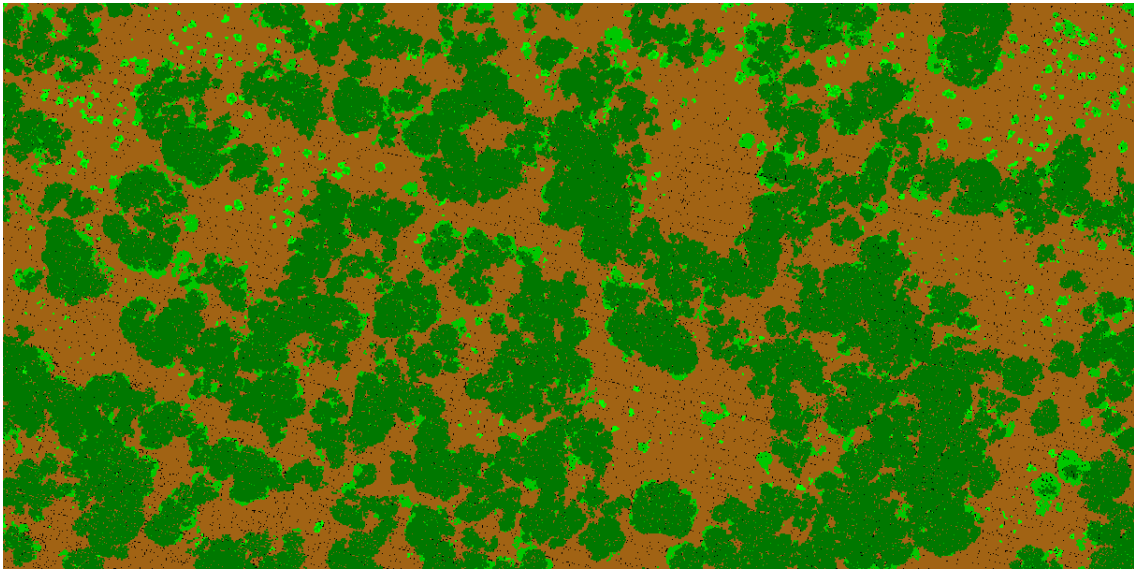
SITE RATING OVERVIEW





DATA

Anditi Classified Point Cloud example



Anditi Ground model example



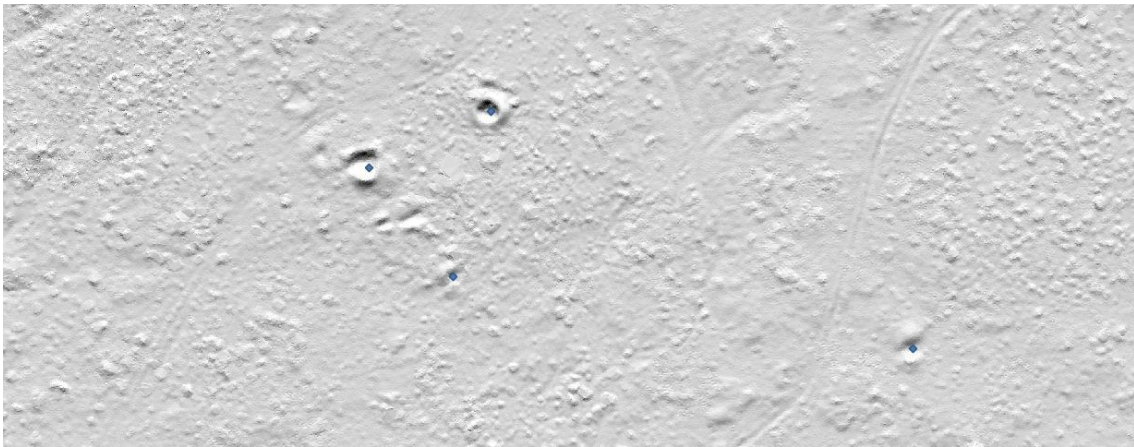
## DATA ANALYSIS RESULTS

Issues discovered in this area that impact Malleefowl mound analysis and rating accuracy.

There is significant human impact on large parts of this area. This impact has created ground modification that is often very similar to Malleefowl mound earthworks or earthwork remnants. These human ground modifications take the form of conical mounds, circular mounds and ground depressions.

Rather than potentially risk removal of Malleefowl mounds that may have been created amongst these human ground modifications, Anditi has chosen to leave ambivalent earthworks as mounds rated 3. The outcome is that there will potentially be false-positive Malleefowl mounds rated 3 – creating potentially many more Malleefowl mound candidates than truly exist. Without local knowledge and fieldwork, Anditi feels that in this case it is a preferable option.

Malleefowl mound-like shapes. Anditi does not believe these are actual Malleefowl mounds, however they have all of the signature ground shape that defines a Malleefowl mound so Anditi has chosen to mark these as rated 3.



Human modified ground that has some of the characteristics that would cause the Anditi algorithms to identify these areas as being potential Malleefowl mounds. Especially where localised depression shapes occur.



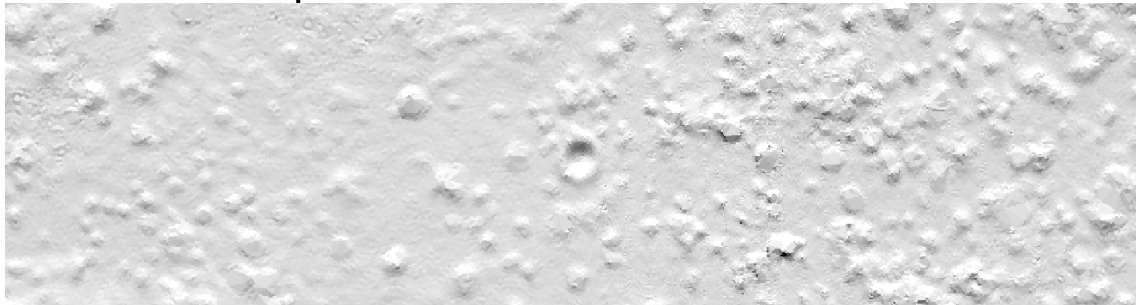


Rated 1	Rated 2	Rated 3
8	27	284

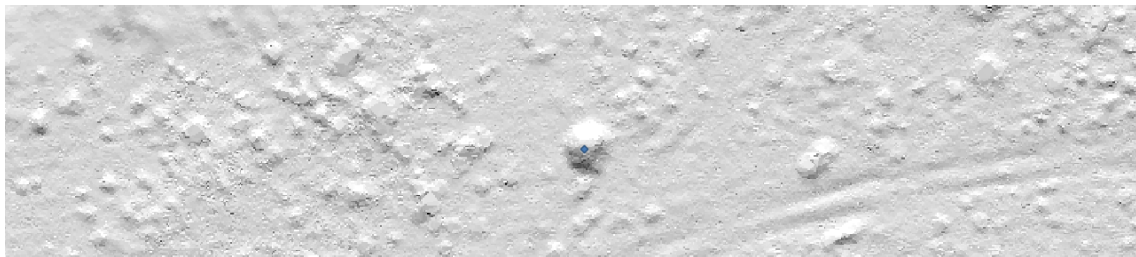
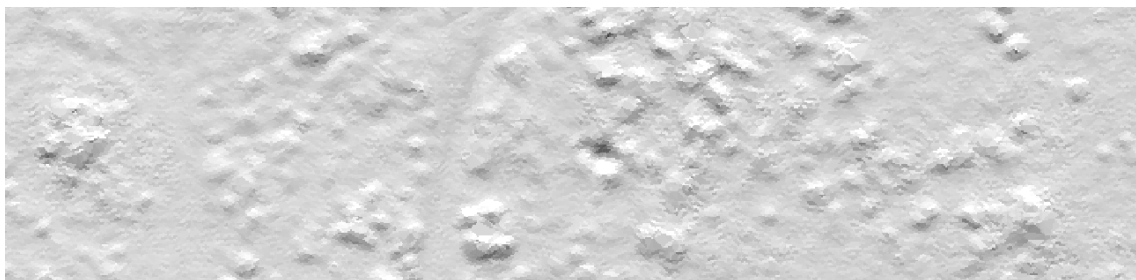
**1 Rated mounds example**



**2 Rated mounds example**



**3 Rated mounds example**





## Conclusions

There is significant variation across this site, from extensive mining operations in the South and South-East, human terrain modification across the site, a ridge through the centre and otherwise largely flat ground with sparse to mid-levels of vegetation.



There are some very good candidates for actual Malleefowl mounds but they are somewhat lost in the noise of the manmade terrain features, with much of the site showing some past human impact in the terrain and vegetation. The mounds rated 1 and 2 appear from the remotely sensed data (LIDAR and Imagery) to closely resemble actual Malleefowl mounds.

A second round of visual inspection was completed to significantly reduce the false positives rated 3. It should be noted that there will still be false-positives in this dataset as man-made features mimic the shape and size of Malleefowl nests and depressions to the extent that it is not possible to exclude these accurately from remote-sensing data (LIDAR and Imagery). It is also possible that a few Malleefowl mounds were accidentally cut in the process as they may have been amongst man-made features and thus deemed false positives.

