



## MT GIBSON IRON ORE MINE AND INFRASTRUCTURE PROJECT

# FIVE YEAR PERFORMANCE REVIEW REPORT Mt Gibson Iron Ore Mine and Infrastructure Project 2020



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### **1. INTRODUCTION**

#### 1.1. Scope

This Performance Review Report describes the environmental performance of the Mt Gibson Iron Ore Mine and Infrastructure Project (the Project) in relation to the key environmental factors identified by the Environmental Protection Authority (EPA) over the second five year period of mining operations. This report covers the period from 23<sup>rd</sup> of June 2015 to the 23<sup>rd</sup> June 2020 and addresses condition 5-1 of Ministerial Statement 753:

The proponent shall submit a Performance Review report every five years after the start of grounddisturbing activities to the Environmental Protection Authority, which addresses:

- 1. the major environmental issues associated with implementing the project; the environmental objectives for those issues; the methodologies used to achieve these; and the key indicators of environmental performance measured against those objectives;
- 2. the level of progress in the achievement of sound environmental performance, including industry benchmarking, and the use of best available technology where practicable;
- *3. significant improvements gained in environmental management, including the use of external peer reviews;*
- 4. stakeholder and community consultation about environmental performance and the outcomes of that consultation, including a report of any on-going concerns being expressed; and
- 5. the proposed environmental objectives over the next five years, including improvements in technology and management processes.

#### **1.2. Project Overview**

The Project is located approximately 350km north east of Perth in Western Australia (Figure 1). The site is immediately adjacent to the Great Northern Highway, approximately 80km north of Wubin.

The Project consists of two separate phases of mining. Mount Gibson Mining Limited (MGM) is responsible for mining direct shipping grade hematite ore and Extension Hill Pty Ltd (EHPL) is responsible for the magnetite mining component of the Project.

The hematite mining component of the Project commenced in 2010 and is currently operational. Hematite ore is mined using standard open cut blasting and excavation techniques. The ore is crushed and screened on site, then transported by road and rail to Geraldton Port for shipping. Transport of the hematite ore was assessed and approved by the Western Australian Minister for the Environment in a separate proposal (Ministerial Statement 786) and is not covered in this report.

The magnetite component of the Project, which is yet to commence, involves the mining of approximately 1,000 million tonnes of magnetite ore over a period of approximately 40 years. Magnetite will be processed by crushing, grinding and magnetic separation to produce a concentrate which will be transported through a pipeline to Geraldton Port for shipping. The concentrate pipeline will form part of a services corridor between the mine site and Geraldton Port which will also include water pipelines to transport recycled water back to the site (via Three Springs) and fresh groundwater from the Tathra borefield.

Mine infrastructure required for the Project includes, administration areas, workshops, crushers, processing plant, and accommodation camps. The infrastructure for the Hematite Operation is shown in Figure 2. The final design of the Magnetite Operation infrastructure is yet to be confirmed.

The vegetation disturbance footprint for the overall Project is not to exceed 1,179 hectares at the mine site, 112 hectares for the services corridor, and 39 hectares for a power line corridor between the mine site and the South West Interconnection System grid near Three Springs.

As of 2020, as reported in the annual environmental report to DWER, the total area of development is 220.42ha including exploration activities, as entitled by statement 753.



**Figure 1 Project Location** 



Figure 2 Hematite Site Layout (including Iron Hill Deposits Statement 1045 to the south)

### 2. ENVIRONMENTAL PERFORMANCE

The Environmental Protection Authority identified four key environmental factors relevant to the Project in Bulletin 1242 (November 2006):

- Flora;
- Vegetation;
- Fauna; and
- Mine Closure and Rehabilitation.

Table 1 presents a summary of these factors, the associated environmental objectives, methodologies and key performance indicators. Further discussion of each factor is included below.

As there has been no disturbance to date for the services corridor aspect of the Project, the risks and management actions associated with this aspect of the Project are yet to be triggered and are therefore not addressed in this review.

### Table 1 Key Environmental Factors

Factor	Objectives	Methodology	Performance Indicators
<b>Flora</b> Impacts on significant flora species, specifically <i>Darwinia</i> <i>masonii</i> (DRF), <i>Lepidosperma gibsonii</i> (DRF) and <i>Acacia cerastes</i> (P1).	<ul> <li>To facilitate the continued <i>in situ</i> survival and improvement of conservation status of <i>D. masonii</i> and <i>L. gibsonii</i>.</li> <li>To maintain (or improve) the conservation status of significant flora species.</li> <li>Ensure that mining and other activities of the mine, particularly the generation of dust, do not lead to a further decline in the local population of the species.</li> <li>Minimise the potential for the impact of weeds and weed management on significant flora.</li> </ul>	<ul> <li>Research programs;</li> <li>Population surveys/monitoring;</li> <li>Seed and germplasm collections;</li> <li>Dust, weed and fire management practices;</li> <li><i>Darwinia masonii</i> Recovery Plan issued by DBCA in 2019 and <i>Lepidosperma gibsonii</i> Interim Recovery Plan.</li> </ul>	<ul> <li>The number of <i>in situ</i> individuals in areas of current occupancy outside of direct mining operations to remain stable or increase;</li> <li>Deposited dust on significant species &lt;4g/m<sup>2</sup>/month;</li> <li>Distribution and number of weed species.</li> </ul>
Vegetation The proposal requires a total of up to 1,330ha of vegetation disturbance.	<ul> <li>To maintain or improve the conservation status of significant floristic communities.</li> <li>To prevent the spread of existing weeds and the establishment of new weeds within the mine site caused by the activities of the proponent.</li> <li>To control and/or eradicate weeds within the mine site.</li> <li>To reduce the risk of unplanned fires and provide contingency measures to minimise the impacts of fires on the local environment.</li> </ul>	<ul> <li>Weed surveys and control programs;</li> <li>Fire prevention and control procedures;</li> <li>Rehabilitation activities.</li> </ul>	<ul> <li>Distribution and number of weed species;</li> <li>Impact and number of unplanned fires affecting native vegetation;</li> <li>Closure completion criteria.</li> </ul>
<b>Fauna</b> Potential impacts on Malleefowl ( <i>Leipoa ocellata</i> ), Western Spiny-tailed Skink ( <i>Egernia stokesii badia</i> ), Peregrine Falcon ( <i>Falco peregrinus</i> ), Major Mitchell's Cockatoo ( <i>Cacatua leadbeateri</i> ), Rainbow Bee- eater ( <i>Merops ornatus</i> ).	<ul> <li>Maintain the abundance, diversity, geographic distribution and productivity of significant fauna species.</li> </ul>	<ul> <li>Restricted access procedures to sensitive areas;</li> <li>Monitoring surveys;</li> <li>Fire prevention and control procedures;</li> <li>Malleefowl Management Plan.</li> </ul>	Qualitative assessment of active malleefowl mounds and their locations on the tenements.

Factor	Objectives	Methodology	Performance Indicators
<u>Mine Closure and</u> <u>Rehabilitation</u>	<ul> <li>Achieve construction of landforms which are stable, non-polluting and aesthetically compatible with the surrounding landscape.</li> <li>Ensure that closure planning and rehabilitation are carried out in a manner satisfying current best practice and consistent with the agreed end land uses.</li> </ul>	<ul> <li>Undertake progressive rehabilitation as areas become available;</li> <li>Rehabilitation monitoring.</li> </ul>	<ul> <li>Availability of sufficient rehabilitation materials.</li> <li>Achievement of closure completion criteria.</li> </ul>

### 2.1. Flora

There are two Declared Rare Flora species (*Darwinia masonii* and *Lepidosperma gibsonii*) and one Priority 1 ranked flora species (*Acacia cerastes*) within the Project disturbance areas. The *Darwinia masonii* and *Lepidosperma gibsonii* were managed in accordance with their respective approved Species Recovery Plans. To date, records show removal of 1,702 *Darwinia masonii*, 819 *Lepidosperma gibsonii* and 102 *Acacia cerastes*.

#### <u>Research</u>

Various translocation trials have been conducted to date, the first involving only *D. masonii* and the second also including *L. gibsonii* and *A. Cerastes*. In 2005 Botanic Gardens and Parks Authority (BGPA) commenced the first trial which demonstrated that *D. masonii* seedlings (propagated in a nursery from cuttings) can be successfully established in natural habitat. This trial involved planting 206 individuals in a fenced, irrigated area on an old drill pad and a further 20 individuals outside the first two summers. BGPA (2010) reported 89% survival of the irrigated plants and 10% survival of the non irrigated plants. Additional inspection of this trial area in March 2014 found 80% of the previously irrigated plants were still alive. All of the tagged plants outside of the fenced area were dead, however new seedlings and juveniles were identified outside of the fenced area. The first flower was recorded on one of these second generation plants in July 2015.

The second translocation trial, commenced in 2009, tested four different substrates, rocky ridge, gravel slope, sand plain and clay plain. There were three replicate plots of each substrate, with 65 individuals of each *D. masonii*, *L. gibsonii* and *A. cerastes* in each plot (BGPA 2010). Despite a lack of irrigation in this trial design, there was 38% survival of *D. masonii* in the rocky ridge substrate and 23% survival in the gravel slope substrate after 20 months (Ruoss 2013). *D. masonii* did not survive in the sand or clay plain substrates. *L. gibsonii* fared slightly better with 59% and 69% survival in the rocky ridge and gravel slope sites respectively and some survival in both the sand plain (16%) and clay plain (2%) (Ruoss 2013). *A. cerastes* had 99.5%, 95% and 94% survival in rocky ridge, gravel slope and sand plain sites, respectively but only 14% survival in the clay plain site (Ruoss 2013). Inspection of the rocky ridge and gravel slope sites in April 2015 found 51 *D. masonii* still alive but with no evidence of flowering from previous seasons. *L. gibsonii* was also still present in these plots and *A. cerastes* had significant representation.

A third translocation trial commenced in 2015 with the objectives of determining if wild grown *D. masonii* seedlings can be dug out and translocated, and if *D. masonii* can be established in the mine site constructed waste dump landform. Progress with this trial has been reported to DWER annually through the submission of annual environmental reports. The excerpt below is a summary of progress at the third translocation trial outlined in the 2019 AER:

"Monitoring of the Darwinia masonii trial translocation to the Extension Hill WRL continued during the reporting period. The trial was commenced in June 2015 by translocating 15 Darwinia masonii that were naturally growing in topsoil stockpiles to the WRL and including five additional Darwinia masonii that were grown in a nursery from cuttings as control plants. All 20 plants are still alive and 18 were recorded flowering on the 26<sup>th</sup> September 2019. The average total growth from the commencement of the trial to 26<sup>th</sup> September 2019 is 102.8cm. The results to date continue to indicate that Darwinia masonii is capable of surviving transplantation of wild grown seedlings and that the WRL cover material is suitable for the survival of these plants."

Plate 1 illustrates the status of the Extension Hill WRL Darwinia masonii translocation trial.



Plate 1 Extension Hill WRL Darwinia Masonii translocation trial (September 2019)

Additional Project funded research was conducted by BGPA in accordance with the *Conservation and Restoration Research Proposal Darwinia masonii and Lepidosperma gibsonii* (BGPA 2008). The outcomes of this research are detailed in BGPA (2010) which was included as an Appendix to the 2011 Annual Environmental Report submitted to DWER.

Darwinia masonii from Extension Hill had been held in nursery since before the ground was cleared for the mine pit in 2010. Some of this stock, which were cleared under Statement 753, were then cloned into juveniles and were able to be translocated back to the wild under a DPaW-approved Translocation Proposal in 2016. One translocation plot was planted out with 309 specimens which were grown in an irrigated, wire fenced plot. Further details are given annually to DBCA, with the most recent data outlined in the report entitled "*Darwinia Masonii and Lepidosperma Gibsonii Translocation Report December 2018 - December 2019*" (MGM, 2020).

The plot was among the first being developed in a series of other plots hosting translocated cloned D.masonii. Irrigation supply was turned off in 2018 and by late 2019 many of the plants had not survived as illustated in Figure 3. It influenced the decision to continue to water translocated plants in the other established plots, carrying over 3,000 D.masonii plants. It was also noted that the plants in Plot 23 were not as well dug nor watered in during the establishment phase and this may have resulted in a reduced medium term survival. That finding was used to improve the way that the subsequent plots were set up elsewhere as part of the overall Translocation Proposal.



Figure 3 Survival of Darwinia masonii translocation seedlings at Plot 23

Due to the success of the various translocation trials outlined above, MGM established six translocation plots of *Darwinia masonii* and *Lepidosperma gibsonii* throughout 2017 and 2018 in accordance with approvals granted under Ministerial Statement 1045 for the Iron Hill Project. Progress with these trials is reported separately to DWER through submission of Annual Compliance Assessment Reports (ACAR). The most recent ACAR was submitted to DWER in March 2020.

#### Population census

The pre-disturbance population of *D. masonii* was estimated at 14,315 adult plants, 1,723 seedlings and 540 dead plants (ATA Environmental 2004). MGM commissioned a complete re-census of the entire *D. masonii* population in 2014. There were 19,132 mature individuals, 1,580 juveniles (plants 10-50cm with no flowering/fruiting present), 188 seedlings and 65 senescent plants recorded (Eco

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Logical 2014). This re-census included 172 plants in the translocation plot commenced by Botanic Gardens and Parks Authority (BGPA) in May 2005. The re-census does not include the 1,702 plants disturbed by mining operations to date. Also excluded are 51 plants remaining from the second translocation trial commenced in 2009, 28 plants (ranging from seedlings to juvenile to mature plants) naturally re-growing in stockpiled topsoil and 6 juveniles re-growing in a previously disturbed area adjacent to the southern end of the mine pit. The total number of live individuals of *D. masonii* currently known to exist is 20,985, compared to 16,038 at the commencement of mining operations.

The population increase is thought to be attributable to the survival of seedlings recorded (and not recorded) by ATA Environmental (2004), the discovery of extensions to existing populations and also the differing survey techniques employed (Eco Logical 2014).

The initial EPA assessment of the Project was based on the known population of 17,615 individuals of *L. gibsonii* (EPA 2006). Subsequent additional surveys conducted in 2008 resulted in a known population of 45,002 plants prior to the commencement of mining operations (ATA Environmental et al 2008). The identification of new populations and subpopulations through opportunistic discovery by mine site personnel and further surveys conducted by a Project funded Department of Parks and Wildlife Conservation Officer has resulted in a current conservative population estimate of between 60,000 – 70,000 plants (DPaW 2014).

The population estimate for *A. cerastes* has not changed since the initial assessment, with the exception of the individuals removed within the mining development.

#### <u>Health Monitoring</u>

Health monitoring of the two DRF species is undertaken through visual inspections, including allocation of a general health score for the plot, and photographic records conducted weekly at three monitoring sites in the populations closest the mine pit and monthly at an additional 6 sites further from the Project disturbance areas. An annual monitoring survey includes a minimum of 715 individuals of each of these two species and records plant height, basal diameter (for *L. gibsonii* only), reproductive status, age (seedling, intermediate, adult or senescent), health score, seedling recruitment and attrition. There has been no detrimental effect on either species ecology associated with mining activities to date.

#### General Environmental Management

Dust management practices include the use of water sprays and chemical dust suppressants, and reporting processes for excessive dust events to enable rapid response. Eleven dust deposition bottles are distributed across the site, eight of which are situated within populations of either *D. masonii* or *L. gibsonii* to record any dust. Dust deposition monitoring results did not exceed the standard of  $4g/m^2/month$  at any of the dust deposition gauge sites where there were adjacent DRF (based on insoluble dust fraction as per the site's Prescribed Premises Licence). Settled dust was observed in the populations adjacent to the mine pit (within the approved disturbance area) but did not appear to be affecting health of the plants which had lower mortality and similar health scores to other monitoring plots further from the mining operation (MBS Environmental 2020).

Weed management practices on site include vehicle hygiene requirements and inspections, an ongoing weed eradication program and site weed surveys to identify any new populations requiring management. The annual weed surveys have identified a small number of weeds that are new to site as well as pre-existing weeds and some species that were not previously recorded at Extension Hill though 'likely to have persisted for some time' (MBS Environmental 2020). The greatest concentration of weeds identified was at the mine site village where it is unlikely to impact on significant flora species or communities. There is also a legacy population of maltese cockspur on nearby Iron Hill from historical drilling and mining activities. Both of these areas are being managed with a combination of manual removal and weed spraying, as appropriate.

#### 2.2. Vegetation

The Department of Biodiversity, Conservation and Attractions have listed the Mt Gibson Ranges vegetation complexes as a Priority Ecological Community (PEC) at a Priority 1 level. In order to manage the Project near this vegetation community, the layout of the Project was designed to take advantage of existing cleared areas and tracks, including a decommissioned, historical air strip, in order to reduce the requirement for additional vegetation clearing.

In addition to the weed and dust management activities discussed in Section 2.1, other general environmental management practices include:

- restricting personnel access to eliminate any unnecessary activities within areas of native vegetation;
- vegetation clearing permit systems to ensure any clearing is undertaken in a controlled manner with clearly demarcated boundaries only after adequate assessment of risks has occurred;
- harvesting of rehabilitation materials (discussed further in Section 2.4);
- hot works permitting systems, smoking restrictions, fire breaks and emergency response capabilities to reduce the potential for and impact of unplanned fire
- hydrocarbon and hazardous waste storage requirements and surface water drainage and diversion systems to minimise the risk of contamination of soil, groundwater or vegetation; and
- waste management systems designed to minimise the amount of waste generated and the amount disposed of.

#### 2.2.1 Priority Ecological Community

Eco Logical (2016) floristic groups are associated with the ironstone hills and slopes and, because of floristic compositions, are each considered to be key components of the Priority 1 PEC 'Mount Gibson Range vegetation complexes (banded ironstone formation)'. In the region the DBCA PEC is shown at two areas of occurrence and it is primarily mapped on and around the Mt Gibson Ranges. Figure 4 shows the DBCA PEC boundary in relation to the Project area and the key component of the PEC which comprises FG10, FG11, FG12 and FG13 from Eco Logical (2016). From Figure 4, MGM has demonstrated that the actual PEC boundary is significantly less than the original boundary previously generated by DBCA.

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Figure 4 Mapped vegetation of the Project area

#### 2.3. Fauna

#### <u>Malleefowl (Leipoa ocellata)</u>

Malleefowl management is undertaken pursuant to the *Extension Hill and Extension Hill North Malleefowl Management Plan.* There has been no impact to the malleefowl population observed as a result of the Project. Initial ground truthing surveys of the area prior to Project implementation identified 113 malleefowl mounds, of which 15 were recorded as active (in use for breeding). A second round of mound monitoring prior to the commencement of mining activities recorded only 5 active mounds, indicating that there is significant variability year to year. This was reflected in the annual survey results, with the number of active mounds fluctuating between 8 and 14 during subsequent monitoring programs. Qualitative consideration of the specific mounds being utilised by the birds showed no evidence of a preference for or shift to mounds further from mining operations.

Pre-disturbance inspections and opportunistic sightings identified a further 17 mounds during the period from 2010 to 2014. In 2013 MGM, together with Terrestrial Ecosystems and Aerometrex trialed the use of high definition aerial photography to search for malleefowl mounds over the tenement area (Thompson et al 2015). This technique identified a further 180 mounds and a monitoring survey conducted in November and December 2014 recorded 21 active mounds. This research was presented at the Goldfields Environmental Management Group Workshop in May 2014 and the National Malleefowl Forum in Dubbo, NSW in September 2014. The study was also published in the CSIRO's *Pacific Conservation Biology* journal.

Surveys of all annual and "5 yearly mounds" have subsequently been completed by MGM in collaboration with the National Malleefowl Recovery Team. A summary of conclusions from the most recent survey (NMRC, 2019) are reproduced below:

#### Seasonal Conditions

The 2019 season in WA is a little drier than 2018 with no corresponding effect on Malleefowl nesting activity. 15 mounds being recorded as active at Mt Gibson compared with 15 last season.

#### <u>Mound Monitoring Data</u>

 Active mounds
 15
 (15 in 2018)

 Ambiguous Active
 0

 Inactive mounds
 204

 % Active
 6.8
 (6.9% in 2018)

 Not found
 0

#### <u>Active Mounds</u>

The active mounds this season are 045 (10), 087 (4), 099 (8), 153(1), 160 (1), 166 (1), 170 (1), 174 (5), 180 (5), 184 (4), 210(2), 215 (6), 222 (2), 244 (1) & 254 (3)

(The numbers in brackets indicates the number of times that mound has been recorded as active.)

Mounds 153, 160, 166, 174 & 244 were recorded as being active for the first time.

Mound 215 has been recorded as active each of the six years it has been monitored.

#### New Mounds

One mound not previously recorded was located at GPS Location -29.56064 S 117.12689 E and has been labelled as new mound 362.

#### <u>5 Year Mounds</u>

3 mounds were re-classified as '5 year mounds', being numbers 067, 135 & 341. All '5 year mounds' are due to be monitored in 2020.

The next round of the annual and "5 yearly mound" surveys is scheduled to be completed by MGM in October 2020. The work will once again be completed in conjunction with staff and volunteers from the National Malleefowl Recovery Team.

#### Other Significant Species

A targeted survey for western spiny-tailed skink (*Egernia stokesii badia*), peregrine falcon (*Falco peregrinus*), major mitchell's cockatoo (*Cacatua leadbeateri*) and rainbow bee-eater (*Merops ornatus*) was conducted in 2013 and found evidence of all of these species in small numbers on the tenements (Ecologia 2014).

General terrestrial vertebrate fauna surveys were undertaken in 2008 (baseline), 2011 and 2013 to monitor for impacts resulting from mining disturbances (Coffey Environments 2008, Terrestrial Ecosystems 2012, 2014). Due to the small numbers of significant species and difficulty associated with detecting impacts within limited populations, particularly of avifauna, the general terrestrial fauna surveys were used as a proxy for the significant species. No further studies were completed beyond 2014 as hematite mining in the EH pit ceased in 2016.

#### 2.4. Mine Closure and Rehabilitation

Prior to the commencement of ground disturbing activities rehabilitation materials including seed, plant cuttings and clumps of declared rare flora, topsoil and growth media were harvested. The quantities of topsoil and growth media currently available are shown in Table 2.

Location	Component	Volume <sup>*</sup> (m <sup>3</sup> )
EH Waste Dump	Tritter	4894
	Topsoil	10,900
	Subsoil	57,418
Waste Dump Cell 1	Subsoil	0
Mine Pit (Community FCT 10-01)	Tritter	2,656
	Topsoil	2,153
	Regolith/Subsoil	0
Mine Pit (Community FCT 10-02)	Tritter	0
	Topsoil	0
	Subsoil	10,374
Village	Topsoil/subsoil	8,273
Sewage pond	Topsoil/subsoil	1,685
Admin/workshop/crusher	Topsoil/subsoil	21,168
Admin/crusher rd.	Topsoil/subsoil	792
Turkeys nest	Topsoil/subsoil	0
Magnetite stockpile area	Topsoil/subsoil	2,063
Magnetite village	Topsoil/subsoil	2,880
Loadout (old GNH)	Topsoil/subsoil	5,215
IH Rd stockpile	Topsoil	10,041
IH infrastructure stockpile	Topsoil	10,233
	Total	150,745

#### Table 2 Rehabilitation Material Available

\*Volume available as confirmed by survey data in January 2019.

Significant areas of the project were progressively rehabilitated during 2018, bringing the total rehabilitated area on site up to 104.68ha. Seeding of all newly rehabilitated areas was conducted soon after deep ripping on the contour was complete. Further rehabilitation of other domains will be scheduled prior to closure of the site.

Annual ecological function analysis monitoring was undertaken each year from 2017 onwards, with the most recent round completed in December 2019, the results of this monitoring project are contained in Botanica (2020). The following is an extract of the main conclusions from Botanica (2020):

Waste Landform

This is the third year that EFA monitoring has been carried out on the Waste Landform. Rehabilitation of this landform has been conducted to date in four stages with rehabilitation completed:

- 2013 on the western face of the landform (T7 and T8);
- 2016 on the eastern/ southern/ south-western face (T1-T6).
- 2017 on the second lift of the WRL, west, south and eastern faces (T9-T12)

• 2018 on the second lift, northern face (first and second lift), and north western face of the top lift (T13 – T19)

A total of 72 perennial species were recorded across the Waste Landform (majority of vegetation being in the 2013 Rehabilitation area) including mid-storey species of Acacia, Melaleuca and Grevillea and understorey Chenopods (Maireana spp., Sclerolaena spp.). A total of six annual species and one weed species were also recorded across the Waste Landform.

In 2018, Transect 6 recorded the highest stability (58%), infiltration (23%) and the highest level of nutrient cycling (19%) of all the Waste Landform transects. Transect 17 recorded the lowest stability value (47%), infiltration value (18%) and nutrient cycling value (11%).

The 2013, 2016 and 2017 rehabilitation which had been monitored previously showed increases in perennial species density and richness, following the 2019 monitoring. The LFA indices had generally remained unchanged between the 2017 and 2018 monitoring. These figures slightly decreased in 2019 following a very dry year, where annual rainfall was well below the average.

As this is only the second year of monitoring for the 2018 rehabilitation, no landscape function trends can be determined. With time, the LFA indices should show trends which move towards the values represented by the analogues. Continued monitoring will determine if the rehabilitation is moving towards a safe, stable and self- sustaining structure.

Table 3 is a summary of EFA monitoring results for the waste landform, compared with target values generated from analogue sites.

WRL Rehabilitation		Stability (%)		
	2016	2017	2018	2019
2013	59.6	58.3	58.83	58.4
2016	54.6	55.6	57.49	56.3
2017	n/a	56.9	56.81	56.9
2018	n/a	n/a	47.27	47.2
Target	≥50%	≥50%	≥50%	≥50%

## Table 3 Mean Waste Rock Landform rehabilitation results, compared to the completion criteria targets

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WDI Debebilitetien				
	2016	2017	2018	2019
2013	18.7	28.4	25.83	22.2
2016	21.3	20.6	22.35	22.9
2017	n/a	19.2	19.2	19.4
2018	n/a	n/a	18.31	19.75
Target	≥20%	≥20%	≥20%	≥20%
WDI Dehebilitation	Ν			
	2016	2017	2018	2019
2013	15.3	26.2	22.09	18.97
2016	14.1	17.7	18.32	18.21
2017	n/a	16.3	16.22	13.25
2018	n/a	n/a	11.63	11.63
Target	≥15%	≥15%	≥15%	≥15%
WDI Dehebilitation	Spec	cies Richness (10	00m²)	
	2016	2017	2018	2019
2013	7	10	11	7.6
2016	0	7	13	8.37
2017	n/a	0	3	3
2018	n/a	n/a	1	9
Target*	7	6	6	6
WDI Dehebilitation	Plar			
WRL Renabilitation	2016	2017	2018	2019
2013	2450	4150	5300	4300
2016	100	6500	10050	6675
2017	n/a	0	1450	1450
2018	n/a	n/a	133	4500
Target*	4125	5265	6900	6900
		Weed Cover (%)		
WRL Renabilitation	2016	2017	2018	2019
2013	<1	0	0	0
2016	0	<1	0	<1
2017	n/a	0	0	0
2018	n/a	n/a	0	0
Target*	<10	<10	<10	<10

\*60% of mean level values recorded for the Analogue sites



Rehabilitation on the flats

The 2013 rehabilitation had shown an increasing trend, for both the LFA indices and biodiversity parameters, following the 2019 monitoring. The perennial species density dropped slightly in 2019 due to the low rainfall for the year. Species richness exceeded that of the flat analogue transects.

The 2016 rehabilitation LFA indices showed that stability, infiltration and nutrient cycling all increased slightly in 2019. However, species diversity and species density decreased for both the rehabilitation sites and the analogues due to the low rainfall for the year.

The 2017 rehabilitation was monitored for the third time in 2019 showing that the LFA indices is climbing steadily during each year of monitoring. Species density and species diversity remained constant with last year's results.

The 2018 flat rehabilitation was monitored for the second time in 2019 for LFA, showing that the LFA indices has increased slightly from the 2018 monitoring period. 2019 was the first year that the vegetation was recorded. nine perennial species were recorded with a plant density of 4500 plants/ha. No weeds were recorded.

Table 4 is a summary of EFA monitoring results for rehabilitation on the flats, compared with target values generated from analogue sites.

Flat Rehabilitation	Stability (%)		
	2017	2018	2019
2013	45.4	45.68	49.87
2018	n/a	42.19	47.27
Target	≥50%	≥50%	≥50%
Flat Rehabilitation	Infiltration (%)		
	2017	2018	2019
2013	19.93	21.18	21.42
2018	n/a	23.07	18.31
Target	≥20%	≥20%	≥20%
Flat Rehabilitation	Nutrient Cycling (%)		
	2017	2018	2019
2013	16.9	18.43	18.32
2018	n/a	13.08	11.63
Target	≥15%	≥15%	≥15%
Flat Rehabilitation	Species Richness (100m²)		
	2017	2018	2019
2013	9	14	10
2018	n/a	1	9
Target*	6	6	11
Flat Rehabilitation	Plant Density (plants/ha)		
	2017	2018	2019
2013	10900	13000	4300
2018	n/a	1500	2030
Target*	5265	2940	5000
Flat Rehabilitation	Weed Cover (%)		
	2017	2018	2019
2013	0	0	0
2018	n/a	0	0
Target*	<10	<10	<10

## Table 4 Mean flat rehabilitation results, compared to the completion criteria targets

\*60% of mean level values recorded for the Analogue sites



The Proponents have completed a stock take of seed collected from within tenement boundaries and currently stored off-site. At the end of 2019, MGM held 252kg of seed from local provenance species, with additional seed collection planned for late 2020 (subject to seasonal generation of seed).

A Mine Closure Plan for the Extension Hill Hematite Operation was approved by the Department of Mines and Petroleum (now the Department of Mines, Industry Regulation and Safety) in February 2016. It was also submitted to the Office of the Environmental Protection Authority (now DWER) in March 2016. A further revision of the MCP was submitted to DMIRS in conjunction with lodgement of a mining proposal addendum in June 2020 (reg ID 77044). Version 5.0 of the MCP is to be lodged with DWER in the near future.

#### Normalised Difference Vegetation Index (NDVI)

Hydrobiology WA Pty Ltd conducted a Remote Sensing analysis of vegetation quality adjacent to the Extension Hill (EH) and Iron Hill (IH) mine pits (Figure 5). The analysis did these things over the course of five sequential years:

- Examined revegetation and its progression through time on the Extension Hill WRL from a largely bare rehabilitated surface to an area with native vegetation;
- Examined the time series of vegetation quality on standing vegetation within a mining domain before, during and after mining activity.

Sentinel-2 multispectral imagery was acquired in March of each year from 2016 to 2020 to capture potential changes in vegetation quality at reference and test areas. The Normalized Difference Vegetation Index (NDVI) was calculated as a proxy for vegetation cover and foliage quality as it provides a reliable and consistent measure of chlorophyll content (Higginbottom and Symeonakis, 2014; Eamus *et al.*, 2015). The assigned areas of similar setting, shape and areas are shown in Figure 5. Note the Iron Hill test area is vegetation that was approved for clearing but not cleared so the NDVI analysis was to see what temporary effect may be evident. At Extension Hill WRL, the rehabilitated areas (landforming; dressing; ripping; seeding) were completed prior to 2015, so five years of progression in revegetation is evident. As the method advances, broader areas for analysis will be examined in subsequent years. The March period was chosen as there is a strong effect of summer rains on Mid-west native vegetation quality.



## Figure 5 Test and reference areas for analysis at each of Extension Hill WRL and within the Iron Hill mine domain.

Other factors were considered as covariates to NDVI results as study areas have various ridges, slopes and undulating terrains which could potentially affect NDVI when comparisons are made between Test and Reference areas. To investigate their influence on vegetation quality, a linear model was derived using the NDVI as the dependent variable and the terrain topography parameters as explanatory variable.

The combined results for this study show a general increase in vegetative quality / foliage volume at each of the Extension Hill rehabilitation area and Iron Hill uncleared area. NDVI at the Extension Hill test site shows a gradual year on year increase in NDVI and is indicative of the rehabilitation works which occurred and continuing to be ongoing there (Figure 6).



## Figure 6 Year-on-year change in NDVI at Extension Hill reference and test areas showing clear increasing trend in signal (foliage volume/fluorescence) particularly since 2018

The trend in median NDVI is easier to view on Figure 7 as the linear trajectory of NDVI on the Test area is positive and tending to typical median NDVI at the Reference of approximately 0.2. At the current rate of progression, pending good growth and further seed germination with future rains, a period of another two years would be needed to meet the reference area five-year average NDVI level.



## Figure 7 Line trend at Extension Hill WRL showing typical NDVI of reference area and progression of NDVI on rehabilitated (test) area.



## Figure 8 Year-on-year change in NDVI at Iron Hill reference and test areas showing return to original NDVI signal (foliage volume/fluorescence) in 2020.

In particular, the NDVI at the Iron Hill mine domain area returned in 2020 to the values found there before mining operations began (Figure 8). Mining activity ended in early 2019. Note however that the median NDVI in 2018 and 2019 in the reference area was also reduced due primarily the generally dry years across the range (especially summer rainfall). The evidence shows that undisturbed native vegetation standing in immediate proximity to mining operations is only temporarily and slightly indirectly affected during the mining activities. MGM held an approval to take vegetation in the test area, although actual ore body mineralisation and efficiency in mining methods (ie less waste rock stripped and dumped) meant that direct loss of the test area of vegetation was not required.

## 3. STAKEHOLDER CONSULTATION AND BIODIVERSITY OFFSETS

MGM advised its key stakeholders including by letter in early 2019 of the planned suspension of mining operations at the site during 2019. However, by Q2 2019, because of favourable market conditions for sale of previously mined low grade ore, processing and hauling of mined materials continued through the course of 2019 from mine site to Perenjori Rail Siding.

Stakeholders continue to be Australian Wildlife Conservancy, the Badimia People, Pindiddy Aboriginal Corporation, Bush Heritage Australia, Wanarra Station, each of the Shires of Perenjori, Dalwallinu and Yalgoo, the Department of Water and Environmental Regulation, the Department of Biodiversity, Conservation and Attractions, the Department of Mines, Industry Resources and Safety, and Extension Hill Pty Ltd (the tenement holders).

The key environmental issues discussed include malleefowl management, introduced species, weeds, rare flora management, fire and mine closure planning.

MGM was a gold sponsor of the Perenjori Agricultural Show held on the 10<sup>th</sup> August 2019.

Biannual meetings were held with a forum named "Badimia Monitoring and Liaison Committee" to discuss cultural heritage issues and obligations.

Biodiversity offsets funding was provided to Bush Heritage Australia, Pindiddy Aboriginal Corporation and Australian Wildlife Conservancy during this period to be used by the recipient organisations for purposes of on-ground projects, which included management of introduced flora and fauna, re-introduction of native fauna and fire management, on land in the areas immediately surrounding the Project.

The Proponents also continued to fund in accordance with Schedule 2 of Statement 753 as follows:

- Department of Biodiversity, Conservation and Attractions conservation officer during this reporting period.
- MGM and EHPL continued to fund the Gundawa Regional Conservation Association (GRCA) during this reporting period and retained management committee positions for this Association.

During the period, the Proponent's continued to engage with these parties with the aim of making an Agreement for future funding should there be a period of time when mining does not occur on the tenements. In June 2020, parties being GRCA, EHPL and MGM, executed an agreement to suspend funding in the future should there be a period of inactivity in relation to the site's operations in accordance with Statement 753.

## 4. FUTURE WORK

#### Hematite Operation

MGM has completed active mining from the Extension Hill mine pit but has continued to use the associated infrastructure approved under this Project to support the Iron Hill Deposits Project (Statement 1045) and low grade processing project.

A mining proposal addendum (Reg ID 80140) was lodged by MGM with DMIRS in May 2020 to establish the following activities:

- Sub grade ore strip-mined from shallow gravel deposits peripheral to the main pit for grade control, with the objective of optimising utilisation and saleability of identified sub grade hematite ore resources; and
- Construction and operation of a Category 64 Type II putrescible landfill at the base and on top of the current Run of Mine (**ROM**) pad, for disposal of inert and putrescible waste generated by decommissioning and closure activities (licensed by L8495/2010/2).

The proposed amendments are minor works within, or immediately adjacent to, the existing modified operational project area. At the time of preparation, Reg ID 80140 was still under assessment by DMIRS. Following receipt of approvals, MGM plans to implement the sub-grade ore strip mining project in late 2020. In addition, MGM will construct and operate a Category 64 type II putrescible landfill at the ROM pad as part of final mine closure activities, anticipated to occur in 2021.

The Iron Hill Deposits Project (reported in relation to MS1045) progressed to closure during the reporting period. There have since been further opportunities to process sub-grade ore stockpiles from this Project due to favourable economic circumstances. It is anticipated that sub-grade ore stockpiles will be processed by late 2020. The pits otherwise are exhausted of hematite.

At the time of preparation, the final hematite ore is scheduled to be transported to Perenjori Rail Siding (Statement 786) by Q1 CY2021. MGM will, along with EHPL the tenement owners, consider care and maintenance or full closure options for the site.

#### Magnetite Operation

Exploration and resource development activities will continue at the Extension Hill Site in future years. A drilling campaign for magnetite is presently being planned for the mine site.

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