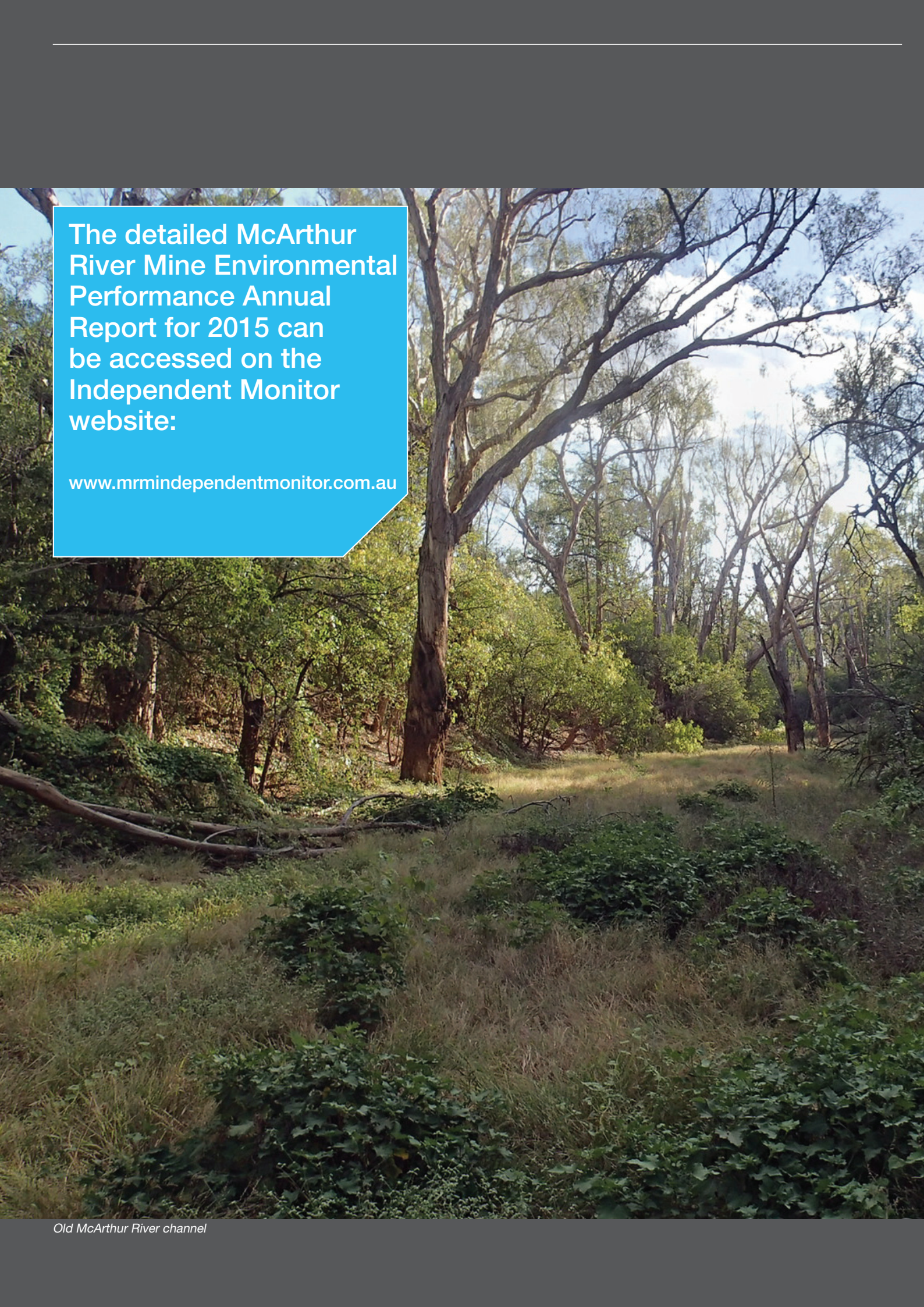


# Independent Monitor **COMMUNITY REPORT**

McARTHUR RIVER MINE

November 2016





The detailed McArthur River Mine Environmental Performance Annual Report for 2015 can be accessed on the Independent Monitor website:

[www.mrmindependentmonitor.com.au](http://www.mrmindependentmonitor.com.au)



## Environmental Performance 2015

### Introduction

The Independent Monitor (IM) has prepared this community report to summarise the findings of the IM review of the McArthur River Mine environmental performance for the 2015 Operational Period (from October 2014 to September 2015).

Improvements noted during this period include:

- Considerable progress in assessment of waste rock and other investigations to inform mine management.
- Ongoing improvements in management of tailings.
- Establishment of an Independent Tailings Review Board.
- Increased vegetation along the McArthur River diversion channel.

A number of areas for improvement have been identified which are detailed in this report.



South east PAF runoff dam

### The Key Issues in this Operational Period

|                                      |   |
|--------------------------------------|---|
| <b>Waste Rock</b>                    | The key issue at the mine site is the long term management of waste rock that has potential to generate acid, saline and metalliferous drainage |
| <b>Tailings Storage Facility</b>     | Management is much improved, but some seepage issues continue   |
| <b>Water Quality</b>                 | There is limited impact on downstream water quality to date, but mine-derived contaminant loads should be calculated                            |
| <b>Bing Bong Loading Facility</b>    | Concentrate shed doors require repair to enable better control of dust  |
| <b>Barney Creek Haul Road Bridge</b> | Dust from haulage is causing localised contamination of water, soil and fish  |
| <b>McArthur River Diversion</b>      | More vegetation has been planted, but rehabilitation is still slow  |
| <b>Long-Term Closure Strategy</b>    | Investigations currently underway need to be collated to develop closure strategies for long-term sustainability of mine facilities             |
| <b>DME Performance</b>               | The DME should establish a register of instructions issued to MRM   |



Southern overburden emplacement facility

### Scope of this Report

The role of the IM is to assess the environmental performance of the McArthur River Mine by reviewing environmental assessments, monitoring and audits undertaken by McArthur River Mining (MRM) and by the Department of Mines and Energy\* (DME).

Issues relating to mine safety, community and social issues, and mine administration matters are not included in the assessment.

The scope of the assessment includes the mine itself and Bing Bong Loading Facility.

\* The Northern Territory Department of Mines and Energy (DME) was renamed as the Department of Primary Industry and Resources during 2016.







## Water Quality

The mine site's impact on downstream water quality is limited, but contaminant loads should be calculated to better understand and manage contamination from the mine.



McArthur River diversion channel (upper) looking towards main river

### What are 'Contaminant Loads'?

Analysing water samples from a river indicates water quality (concentration of contaminants) in water from that river (e.g., grams of metals per litre of water), at a given point in time.

When concentrations are multiplied by the total volume of water flowing down the river, we can estimate the total amount of contaminants going down the river during a longer time period, such as over a year.

This result is the 'contaminant load', and is used to more fully assess the natural amount of contaminants in the river versus those from the mine site.

### Successes

The following successes related to surface water quality were identified by the IM during the 2015 operational period:

- Monitoring indicates that the mine's impact on downstream water quality to date is limited, and the mine generally complies with its discharge requirements.
- A dewatering pump installed in the Barney Creek diversion channel has helped to reduce contamination inputs to the McArthur River.
- Quality assurance of water quality monitoring continues to improve.

### Contaminant Loads

The IM continues to recommend that MRM should annually assess and report on mine-derived loads of contaminants within the McArthur River, in comparison to background (natural) levels of contaminants. This will allow MRM to better understand possible downstream impacts of the mine, as well as defining how much contamination is coming from different parts of the mine site.

Assessment of current and potential contaminant loads is also important to enable informed decisions about options for mine closure in the future.

### Other Recommendations

The IM has recommended that:

- The surface water monitoring program should be reviewed on an ongoing basis to ensure that sufficient early warning is provided of potential impacts on water quality from runoff or leachate from mine facilities.
- In the McArthur River just downstream of the mine, elevated sulfate concentrations and conductivity levels have been identified – MRM should undertake a risk assessment identifying likely causes, possible implications, and mitigation measures if appropriate.



McArthur River at the compliance point downstream of the mine site



## Barney Creek Haul Road Bridge

Monitoring has found ongoing issues of dust, contaminated sediments and fish near Barney Creek haul road bridge. Improvements have been noted, but there is more to be done.



*Barney Creek haul road bridge*

### Dust

Monitoring adjacent to the bridge showed that there were high levels of wind-blown dust for 6 out of 11 monitoring events. Investigation by MRM has found that this relates to haulage of waste rock during drier months. The IM has recommended that MRM develop a dust management plan for this area, and for the broader mine site.

MRM operates several sediment traps near the bridge and a small dam in the diversion channel itself, to reduce runoff of contaminated water and sediment into the creek. These are cleaned out as required. The IM has also recommended that the remaining drain holes in the bridge be closed off.

### Water and sediment quality

Streambed sediments collected in the Barney Creek diversion channel immediately downstream of the bridge contained more lead and zinc than other Barney Creek sites. However, they were much improved compared to 2014. Metals results in water were also elevated compared to upstream sites.

### Fish

As for the past three years, fish caught at the Barney Creek haul road bridge were found to contain lead from mine ore at levels above the maximum permitted under Australian food standards. However, results have continued to improve due to the management measures listed above.



*Sediment control structures at Barney Creek haul road bridge*



## McArthur River Diversion Channel

Revegetation of the diversion channel has increased significantly, but erosion and slow rehabilitation continue to be problematic. MRM has recently undertaken a detailed landform assessment and erosion mitigation strategy.

### What is large woody debris?

In natural rivers, LWD consists of logs and branches that have fallen into the river or been washed downstream. In artificial channels like the river diversion, LWD is missing, but it can be added back.

LWD can improve channel stability by slowing river flow and reducing erosion. It is also important to river ecology, providing habitat and protection for fish and water bugs.

### Revegetation and Weeds

MRM has successfully established more vegetation along the diversion channel, particularly near the waterline. More monitoring of vegetation is being undertaken, and there are fewer weed infestations than in previous years.

Rehabilitation of the diversion channel continues to be slow, and the IM has recommended that MRM prepare a revegetation plan with goals for when the diversion channel should be self-sustaining.

### Erosion of Banks

Erosion from the banks of the diversion channel (as well as immediately upstream) continues to be an issue, due to wet season flooding combined with incomplete revegetation.

During 2016, MRM has undertaken a detailed landform condition assessment and erosion mitigation strategy for the diversion channel; the results of this will be discussed in the next IM report.

### Large Woody Debris

No new large woody debris (LWD) was added to the McArthur River diversion channel during 2015, however the extensive amounts previously added in the downstream end have been retained.

The IM recommends that more LWD be installed, as it has been shown to encourage fish and prawns to return to the diversion channels.



Upper middle part of the McArthur River diversion channel, showing successful revegetation along the waterline



Mid-section of the diversion channel, where there is most erosion



Downstream part of the diversion channel, showing large woody debris installed to create habitat and reduce erosion



## Waste Rock

The key environmental risk at the mine site continues to be waste rock management. MRM is preparing long-term strategies to address these issues.

### What is Acid Rock Drainage?

Acid rock drainage, also called acid and metalliferous drainage, is the outflow of acidic water from rock. A related process is the drainage of saline water from rocks.

'Potentially acid-forming' (PAF) rocks occur naturally in the environment and are harmless when below the groundwater table or deep below the ground surface where oxygen levels are low. When PAF rocks are exposed to air, they can break down, causing acidity.

Similarly, salt and metals are a natural part of rocks and soil, which can leach out when some types of rocks break down in response to air and water. Following rainfall, water containing salt, acid and/or metals can run off into creeks or leach into groundwater.

Acid rock drainage and saline drainage may be controlled by covering rocks with a 'cap' of clay and rock, protecting them from air and water. In some locations, the rock is placed under water, which excludes air and prevents the breakdown of rock.



*NOEF compacted base with waste rock placed over top*

The 2015 review has again confirmed that the potential for acid, saline and metalliferous drainage from mine materials (including waste rock, tailings and the mine pit) is the most significant issue at the mine.

### Improvements

The following successes regarding management of waste rock were noted by the IM during the 2015 operational year:

- Ongoing management of newly mined waste rock to minimise acid rock issues.
- Considerable progress in understanding of waste rock characteristics and distribution at the mine site.
- Completion of various studies to fill information gaps with regards to waste rock management as well as potential water quality in the mine pit after mining concludes.
- Identification of a source of low-risk rock to use as waste rock cover material.

### Environmental Impact Assessment

Ongoing studies and assessments into the nature of waste rock issues on site, as well as potential outcomes of different management options, will be included in the Environmental Impact Statement (EIS) currently being prepared for MRM's Overburden Management Project.

At the time of the IM review, development of closure management strategies had not been finalised and approaches that ensure the successful long-term mitigation of potential impacts have not been demonstrated.

The challenge for MRM is to improve operational controls and develop closure management strategies that will ensure the successful long-term minimisation of environmental impacts. The IM expects that this information will be outlined in the EIS.



## Recommendations

Further actions will arise in light of the Overburden Management Project EIS, which is soon to be released. In the interim, the IM recommends that MRM undertake the following actions:

- Develop performance criteria for waste rock cover system to enable long term monitoring and assessment of performance.
- Develop a new approach to wet season infiltration control given the apparent ineffectiveness of a clay cover.
- Continue to improve control of processes that can lead to spontaneous combustion.
- Carry out more sampling of infrastructure sites within the mine site that have been constructed via cut and fill.
- Increase the frequency of check sampling of waste rock.



Dumping waste rock



Environmental monitoring near the NOEF



The NOEF (background) and early works on a new runoff dam (foreground)



Collecting seepage from the NOEF



## Tailings Storage Facility (TSF)

Operation of the TSF continues to improve, in terms of water management and oversight.

Ongoing and future issues include management of seepage from TSF Cell 1 and planning for long term storage.



*TSF Cell 2 showing most materials being moist with only minor drying at edges*

### What are tailings? How does the TSF work?

Tailings are the ground-up rock remaining after extracting metal from the ore.

The tailings are piped from the mine's processing plant and deposited around the perimeter of the TSF. Here, the ground rock settles out, while wastewater flows to the centre of the TSF and is recycled.

The tailings are deposited in thin layers which allows them to dry out and consolidate, increasing the strength of the TSF.

### Improvements

During 2015, a detailed assessment of groundwater near the TSF was undertaken – although more investigations and modelling are required to fully understand groundwater movement and water quality around the site.

Recovery of seepage from the southwestern corner of TSF Cell 2 continued during the reporting period until June 2015, when seepage effectively ceased.

New controls for the TSF included:

- Upgrades to the water management system and spillway.
- More tailings discharge points (which help to keep stored tailings moist and reduce dust).
- Appointment of an Independent Tailings Review Board to review proposed life-of-mine design, management and closure plans for the TSF.
- Development of a TSF Operation and Surveillance Training manual and training of MRM staff.

### Water in TSF Cell 2

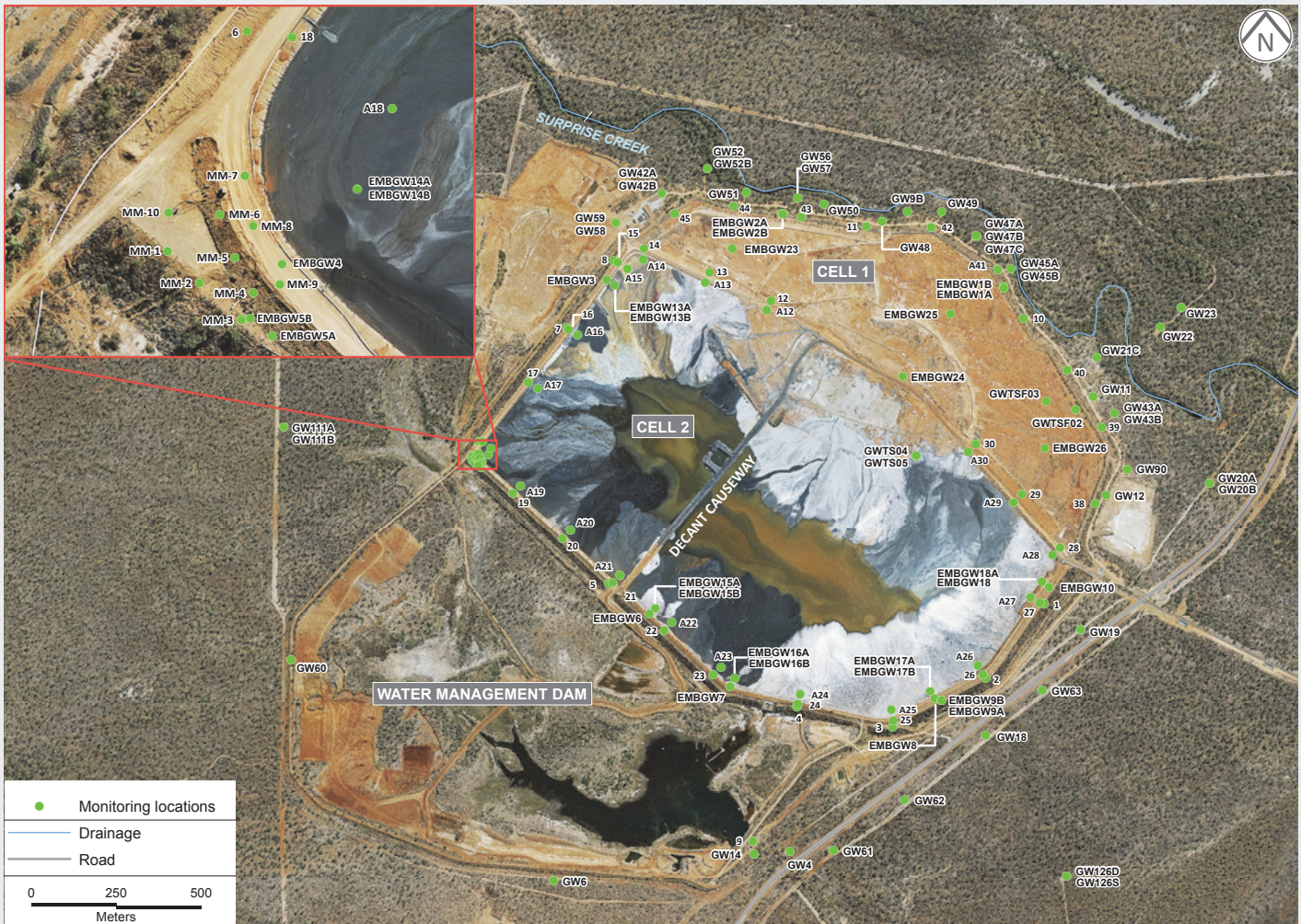
MRM has continued to avoid storing excess water at the TSF – a safer method of operation that minimises risks of bank failure, seepage and/or overtopping. Excess water is now being reclaimed and reused for ore processing activities.

The IM noted that during 2015, MRM was able to keep most of the tailings moist, thereby avoiding dust issues.



*Water reclamation from the TSF*





Overview of TSF showing locations of monitoring sites

### What is the problem with seepage?

Seepage of water from a tailings facility can impact on groundwater quality, for example, making water and soils saltier. There is also potential for release of acidic seepage. This in turn can affect aquatic and terrestrial ecosystems where groundwater is discharged to creeks or the surface.

### TSF Cell 1

No new tailings are being stored in Cell 1 of the TSF, but management is ongoing. The IM notes that modelling and management of water at Cell 1 has improved. Ongoing issues include:

- Capping is eroded in places, and ongoing repairs are localised. As such, runoff sometimes comes into contact with tailings below the cap, contaminating that water. The IM recommends that MRM install an improved cover that withstands erosion and prevents water infiltration.
- Seepage towards Surprise Creek appears to have reduced during 2015 (which was a dry year), however it is an ongoing issue, which existing measures are not adequately controlling. The IM recommends that MRM review the strategy for managing water and seepage.

### Closure

A plan is currently being prepared by MRM for the mine's eventual closure, including consideration of how best to manage tailings in the long term. The preferred and safest option would be to store them underwater in the mine pit.



## Bing Bong Loading Facility

At Bing Bong Loading Facility, management of dust resulting from MRM's activities is an ongoing issue. However, environmental impacts of the facility are limited.



*Ship loader at Bing Bong Loading Facility*

### Successes

During a site visit in April 2016, the IM observed that:

- Despite the past 14 months having been drier than usual, less dust was present around the facility compared to 2015.
- The dust extraction system in the concentrate shed has been repaired.
- During 2015, MRM installed a more permanent dust monitoring station. Results from this will be reported next year.

Other successes include:

- Marine monitoring continues to improve, with new monitoring sites for water and sediment, marine fauna and seagrass.
- Impacts of the facility on coastal water quality and marine fauna were found to be relatively low and localised.



*Air quality monitoring station at Bing Bong Loading Facility*





Damaged pavements and concentrate shed doors



Dust extraction system

### Opportunities for Improvement

There were five days during 2015 where monitoring recorded lead in dust exceeding air quality criteria at Bing Bong Loading Facility.

The IM recommends the following to reduce dust issues at this site:

- The bitumen surface surrounding the loading facility should be repaired to avoid dust and potential for contamination of underlying soils – MRM plan to do this during 2016.
- The doors of the concentrate shed have not been able to be closed for at least the past three years. This is a likely cause of dust issues in the local area, and the IM recommends they be repaired as soon as possible.



Satellite image of the area surrounding Bing Bong Loading Facility in 2015



## Fish and Shellfish

Two studies commissioned by the DME found that outside of the mine lease, consuming fish from the McArthur River has very low risk to human health

The 2015 assessment sampled bony bream, spangled perch, chequered rainbowfish, sooty grunter, barramundi and bull shark, as well as freshwater prawns and mussels. New monitoring sites were added on Surprise and Barney creeks.

### Lead

Further to the previous page, lead was highest in fish caught within the mine site from the Barney Creek diversion channel, at and above the Barney Creek haul road bridge, as well as in one mussel sampled a few kilometres downstream of the mine site in the McArthur River. These fish contained lead at levels above the maximum permitted under Australian food standards, which is likely to be derived from the mine.

Lead was not elevated in any fish or shellfish sampled further downstream of the mine.

### Copper

Copper results in fish and prawns were higher in 2015 than 2014, at both the mine site and reference sites. The Australian food standards do not currently specify a maximum level for copper.

As copper was elevated in sites from 20 km upstream of the mine to 40 km downstream (with highest results from upstream of the mine), elevated levels are unlikely to be caused by MRM's operations.



Bony bream  
Source: Thorburn, 2014.



Spangled perch



Sooty grunter  
Source: Thorburn, 2014.



Freshwater prawn  
Source: Thorburn, 2014.

## Cattle Management

Livestock entering the mine site can be a safety hazard and cause damage to revegetation areas. They may also be exposed to metals where these are present on or in grasses due to airborne dust. As such, MRM has continued to work to exclude cattle from the mining lease.

During 2015, MRM developed a comprehensive livestock management plan that addresses fencing (inspections, repairs and upgrades) and monitoring. For any cattle found on site, a new procedure defines management based on whether they are branded and how long they've been on site.

Fencing has been further improved, and the IM noted that there were no signs of cattle at the Bing Bong Loading Facility dredge spoil ponds during the 2016 inspection. Cattle also appear to have been better excluded from the McArthur River and Barney Creek diversion channels at the mine site.

An ongoing challenge relates to maintenance of fences in flood-prone areas.



Brahman cattle in the Northern Territory  
Source: [www.centralstation.net.au](http://www.centralstation.net.au), 2013.



## Review of DME Performance

As well as assessing the environmental performance of McArthur River Mine, it is also the IM's responsibility to review the performance of the Northern Territory Department of Mines and Energy (DME) in regulating and monitoring the mine.

### Successes

The IM notes that:

- The DME have started a regular series of site visits to the mine, and have prepared reports on these within one month of each visit.
- Independent external advice has been engaged by the DME to supplement their internal technical knowledge.
- DME have instructed MRM to appoint independent experts to review mine operations.

### Opportunities for Improvements

The IM has provided the following recommendations to the DME:

- The current MMP review process should be revised to be more efficient.
- MMP commitments should be reduced and collated into a single list within the document.
- The DME should establish a register of instructions issued to MRM.
- MRM should submit an action plan to DME detailing how the IM's high priority recommendations will be addressed.



The McArthur River Mine open pit



## About the Independent Monitor (IM)

At the end of 2013, the DME engaged ERIAS Group Pty Ltd to assess the environmental performance of the McArthur River Mine for a five-year period.

2016 is the third year that ERIAS Group has prepared the environmental performance report, as well as this community report.

The IM is supported by a team of specialists that brings together the required skills and experience to fulfil the role, including:

- ERIAS Group (environmental impact assessment, risk and management, water quality, soils, dust and closure planning).
- Water Technology (diversion channel, surface hydrology and site water management).
- Pells Sullivan Meynink (geotechnical engineering and TSF operating strategies).
- Groundwater Resource Management (groundwater modelling and monitoring).
- Environmental Geochemistry International (geochemistry, TSF and waste rock cover design).
- Low Ecological Services (terrestrial, aquatic and marine ecology).

For more information, go to the IM website:  
[www.mrmindependentmonitor.com.au](http://www.mrmindependentmonitor.com.au)