

ASSESSMENT REPORT 86

MCARTHUR RIVER MINE OVERBURDEN MANAGEMENT PROJECT MCARTHUR RIVER MINING PTY LTD

July 2018

Environmental Impact Assessment Process Timelines

Date	Chronology
27/06/2014	Notice of Intent received
10/07/2014	NT EPA decision issued - Environmental Impact Statement
30/08/2014	Draft Terms of Reference released for public comment
22/09/2014	Final Terms of Reference issued to proponent
15/06/2014	Australian Government decision - Controlled Action under EPBC Act (for accredited assessment process by NT)
10/08/2015	Clause 14A notification received
02/12/2015	NT EPA decision on clause 14A notification
22/03/2017	Draft EIS released for public comment for 6 weeks
19/05/2017	NT EPA direction to prepare EIS Supplement issued
03/04/2018	EIS Supplement received
24/04/2018	Additional information requested
21/06/2018	Additional information received
31/07/2018	Assessment Report issued

Dr Paul Vogel
Chairman

31 July 2018

Northern Territory Environment Protection Authority

GPO Box 3675
Darwin
Northern Territory 0801

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Abbreviations and Glossary

AAPA	Aboriginal Areas Protection Authority
AEP	Annual exceedance probability
Adaptive management	A learning-oriented approach to making decisions on the management of natural resources in the presence of incomplete knowledge or uncertainty. It involves iterations of decision making, monitoring, and assessment of system responses, leading to adapted decision-making (Lee 2014)
Adaptive Management Plan	A plan to be developed in accordance with the recommendations set out in this Assessment Report. For the avoidance of doubt, the term does not mean the plan as presented by the Proponent in Appendix R of the draft EIS Supplement.
Additional Information	Additional information to the draft EIS and the Supplement
Advisory bodies	NTG Agencies having expertise and/or administrative responsibilities in respect of the Proposal
ALR Act	<i>Aboriginal Land Rights (Northern Territory) Act 1976</i>
AMD	Acid and Metalliferous Drainage
ANZECC	Australian and New Zealand Environment and Conservation Council
ARMCANZ	Agriculture and Resources Management Council of Australia and New Zealand
Assessment Bilateral Agreement	An agreement under section 45 of the EPBC Act between the Australian and Northern Territory Government's under which the NT EPA may undertake EIA on behalf of the Australian Government
BGM	Bituminous geomembrane
CBT	Community Benefits Trust
CCL	Compacted clay layer or liner
CoC	Contaminant of concern
Community Reference Group	The group to be established in accordance with Recommendation 26

DENR	Department of Environment and Natural Resources
DoEE	Department of the Environment and Energy (Commonwealth)
DoH	Department of Health
Domains	NOEF, TSF and open pit
DPIR	Department of Primary Industry and Resources
Draft EIS	Draft Environmental Impact Statement
EA Act	<i>Environmental Assessment Act</i>
EAAP	Environmental Assessment Administrative Procedures
ECNT	Environment Centre of the Northern Territory
EDO	Environmental Defenders' Office (NT) Inc
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
ELS	Eastern Levee Storage (dam)
Environment	All aspects of the surroundings of man including the physical, biological, economic, cultural and social aspects (section 3 of the <i>Environmental Assessment Act</i>)
EPDM	Ethylene propylene diene monomer
ESD	Ecologically Sustainable Development
ESIMP	Economic and Social Impact Management Plan
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ERIAS	ERIAS Group Pty Ltd; Environmental consultants engaged as the Independent Monitor for environmental performance of MRM
GL	Gigalitre (a billion litres)
GSL	Geo-synthetic liner
GSP	Gross state product
GW	Groundwater monitoring bore prefix
HDPE	High density polyethylene

ICMM	International Council on Mining and Metals
IM	Independent Monitor appointed by DPIR
Independent panels	Independent panels established for the NOEF (Recommendation 8) the TSF (Recommendation 11) and mine closure (Recommendation 23)
ITRB	The Proponent's Independent Tailings Review Board
LLDPE	Linear low density polyethylene
LOM	Life of Mine
LS-NAF(HC)	Low sulfur NAF with high acid neutralising capacity (benign)
Mineral Lease	The mine site is contained within five contiguous mineral leases: MLN1121, MLN1122, MLN1123, MLN1124, MLN1125 (draft EIS section 1.10.1)
MLN	Mineral Lease Number
MM Act	<i>Mining Management Act</i>
MMP	Mining Management Plan
MNES	Matter of National Environmental Significance
MRM	McArthur River Mine
MS-NAF	Metalliferous Saline NAF (non-benign)
NAF	Non-acid forming material
NGO	Non-government organisation
NIRB	The Proponent's NOEF Independent Review Board
NLC	Northern Land Council
NOEF	Northern Overburden Emplacement Facility
NOI	Notice of Intent
NT	Northern Territory
NT EPA	Northern Territory Environment Protection Authority
NTASS Act	<i>Northern Territory Aboriginal Sacred Sites Act</i>
NT Government	Northern Territory Government

OEF	Overburden Emplacement Facility (waste rock dump)
Operator	The operator for a mining site referred to in section 9 (1) of the <i>Mining Management Act</i>
PAF	Potentially acid forming (non-benign) material
PAF(HC)	PAF with high acid neutralising capacity (non-benign)
PAF(RE)	Reactive PAF (non-benign)
plc	Public limited company
PROD	Perimeter or PAF run-off dam
PWD	Process Water Dam
QA/QC	quality assurance/quality control
relevant regulator	The responsible Minister or delegate or agency responsible for administering the relevant legislation, in most cases the <i>Mining Management Act</i> . This could, in future, include the <i>Water Act</i> and subsequent legislation as the NTG progresses its regulatory reform program for environmental assessment and environmental protection
ROM	Run of Mine
Statement of Reasons	Refers to the Statement of Reasons dated 10 July 2014 published by the NT EPA identifying why the Proposal requires assessment by EIS
sacred site	Has the meaning as defined in the <i>Aboriginal Land Rights (NT) Act 1976</i> – ‘a site that is sacred to Aboriginals or is otherwise of significance according to Aboriginal tradition’. This definition is used in the NTASS Act and other legislation.
SO ₂	Sulfur dioxide
SOCS	Sites of Conservation Significance
SPROD	Southern Perimeter Run-off Dam
SPSD	South Perimeter Sediment Dam
SW	Surface water monitoring site prefix
The Minister	Minister for Environment and Natural Resources

The Proposal	McArthur River Mine Overburden Management Project
The Proponent	Glencore and its mine operator, McArthur River Mining Pty Ltd
The responsible Minister	Minister for Primary Industry and Resources
The Supplement	The Supplement to the draft EIS
The / this Report	Assessment Report 86, for the McArthur River Mine Overburden Management Project
TSF	Tailings Storage Facility
WDL	Waste Discharge Licence under the <i>Water Act</i>
WMPC Act	<i>Waste Management and Pollution Control Act</i>
WMS	Water management system
WTP	Water treatment plant

Units and Symbols

%	percent
>/<	greater than/less than
°C	degrees Celsius
Cd	cadmium
ha	hectare
H ₂ SO ₄	sulfuric acid
kg	kilogram
kL/y	kilolitre per year
km	kilometre
km ²	square kilometre
L	litre
L/s	litres per second
m	metre
m ³	cubic metre
ML	megalitre (million litres)

ML/d	megalitre per day
mg/kg	milligram per kilogram
mg/L	milligrams per litre
ML/y	megalitre per year
mm	millimetre
Mt	mega tonne (million tonnes)
Mt/y	million tonnes per year
Pb	lead
µg/L	micrograms per litre (millionth of a gram)
Zn	zinc

Summary and Recommendations

Environmental impact assessment (EIA) is a process for identifying the potential environmental impacts and risks of a proposed action, evaluating the significance of those impacts and risks and determining appropriate avoidance, minimisation and mitigation measures to reduce those impacts and risks to acceptable levels. This Assessment Report (the Report) presents the findings of the EIA of the McArthur River Mine Overburden Management Project (the Proposal), proposed by McArthur River Mining Pty Ltd, a wholly owned subsidiary of Glencore plc (the Proponent). This report marks the end of the assessment process by the Northern Territory Environment Protection Authority (NT EPA).

Three public submissions were received on the draft Environmental Impact Statement (EIS), all from non-government organisations. The Proponent reported consultation with 566 individuals representing the local community and other stakeholders. To inform its examination of the EIS, the NT EPA undertook its own consultation with 13 Government agencies and three non-government organisations. The NT EPA visited the mine site in June 2017 and May 2018. The NT EPA also engaged its own technical expert for independent advice.

This Report is provided to the Northern Territory Minister for Environment and Natural Resources (the Minister) and to the Minister for Primary Industry and Resources (the responsible Minister) for approvals that would be required for the Proposal. This Report is not an environmental approval although it will guide the decision for a mining authorisation (by the responsible Minister) and the decision for an approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Report will also inform approvals under the *Northern Territory Aboriginal Sacred Sites Act*, *Heritage Act* and *Water Act*.

The McArthur River Mine (MRM) is an existing lead and zinc mine that has been operating since 1993. In 2012, the then Department of Natural Resources, Environment and the Arts and Sport assessed the Phase 3 Development proposal, and it was subsequently approved by the then Minister for Mines and Energy in 2013. The MRM is authorised for the continuation of mining to 2036, and is operating under an approved Mining Management Plan (MMP) covering the period 2015 to 2018.

The basis for referring the Proposal to the NT EPA was the reclassification of waste rock 2.2. The classification system used by the Proponent while operating the open cut mine to 2014 did not match the actual characteristics of the rock being mined and led to a significant under-estimation of the volume of reactive (potentially acid-generating) waste rock. As a result, a large proportion of the waste rock was not handled or stored on the site in a manner to avoid or minimise future seepage of runoff of metals from the site. Exposure of this reactive rock to air and water enabled chemical reactions to occur, resulting in the generation of acidic/metalliferous/saline drainage, and in some areas, spontaneous combustion within the northern overburden emplacement facility (NOEF). The resulting plume of sulfur dioxide from the NOEF in 2014 attracted widespread attention.

To manage this issue, the Proponent has presented a proposal to redesign the NOEF (the principal waste rock dump on the site), to securely store reactive waste rock types that were not accounted for in the original Phase 3 design. The Proposal would result in the NOEF increasing in height from 80 m to 140 m; with the total footprint increasing from 485 ha to 511 ha. Additionally, the Proposal includes updated options for closure of the key domains of the NOEF, tailings storage facility and the final pit void which take account of the revised rock characteristics.

The mine has a 25 year history in the region from operating as an underground operation to its subsequent conversion to open cut. The history of the mine has been

complex and, at times, contentious. The NT EPA notes from submissions during the EIA process that there are substantial concerns about current environmental impacts and serious concerns from some that future impacts will be worse. Several submissions during the review of the EIS recommended that a 'no project' option should be considered.

The NT EPA considers that, to some extent, these concerns reflect a lack of integrated information about actual water quality and biological conditions in the McArthur River, compounded by the difficulty in accessing the results and findings of monitoring programs, and a view that there is not rigorous regulatory scrutiny of the mine's risks and environmental performance.

The NT EPA is mindful that the Proponent has an existing Authorisation and is therefore lawfully permitted to continue operating the mine. The scope of the EIS considered the changed site management necessary and closure implications of erroneous overburden classification, not whether mining should or should not proceed. Although not the Proposal before it, the NT EPA gave careful consideration to the 'no project' option. In doing so, it examined the existing condition of the receiving environment as well as the Proponent's modelling and predictions for future environmental impacts and risks that may arise from current and future operations.

Based on a review of available monitoring data, the NT EPA has concluded that the McArthur River, in terms of water quality and aquatic ecosystems, is in good condition at present. While impacts to water, air, terrestrial and aquatic habitats and biota are generally restricted to the mine site at present, there is potential for future off-site impacts to occur as a result of the Proposal.

In conducting this EIA, the NT EPA analysed the Proposal; the existing environment; the potential impacts and risks of the Proposal and the significance of those impacts and risks; and the proposed avoidance or minimisation/mitigation measures. It also had regard to the principles of ecologically sustainable development (ESD). In consideration of all these elements, the NT EPA formed a view that a central, overarching environmental outcome needed to be achieved. The McArthur River and the values it supports is the critical aspect of the receiving environment for the Proposal that links all identified key environmental factors and that must be protected from mine-related degradation. The NT EPA therefore considers that to meet its environmental objectives, and the principles of ESD, the McArthur River must be maintained in a healthy condition at all times.

The NT EPA takes a strategic and precautionary approach in making **Recommendation 3** to require that the Proposal and all future stages of the mine are implemented in a manner that: requires the health of the McArthur River to be protected along its entire length at all times from mine related impacts; and that the annual loads of lead and zinc discharged to the McArthur River in future years do not exceed the loads discharged in 2017-2018. This **overarching environmental outcome** is the basis for the recommendation that the Proposal should be allowed to proceed.

The NT EPA considers that there is scope for significant improvement to management systems and review processes for the Proposal. This Assessment Report presents a comprehensive and robust package of recommendations that provide for improved: source control of contaminants; environmental monitoring; governance arrangements; transparency; and community engagement. Together, these recommendations provide multiple lines of protection, with the central aim of achieving the **overarching environmental outcome**.

To improve monitoring's ability to inform management and mitigation measures, the NT EPA recommends the Proponent revise and implement a monitoring program (**Recommendations 13**) that: quantifies impacts to water quality at appropriate points;

quantifies loads of lead, zinc and other contaminants of concern entering the McArthur River; measures parameters that may indicate risks to the health of ecosystems and humans; measures trends in water quality; validates predictions and tests model assumptions; and has appropriate site specific triggers for management action. The NT EPA recommends that the results of all monitoring programs are made publicly available.

To improve transparency and allow for constructive scrutiny, the NT EPA recommends changed governance arrangements to replace existing arrangements, including a new **Community Reference Group** and **independent panels**.

The Community Reference Group (**Recommendation 26**), chaired by a person of public trust and appointed by government, would provide for clear communication between broader community interests and mining operations and closure objectives.

Independent expert panels (**Recommendations 8, 11 and 23**) would provide external and transparent oversight and reporting, to advise government and the community on a three-year rolling basis on key aspects of the Proposal including the NOEF, tailings storage facility (TSF) and closure planning. The role of the Independent Monitor (IM) would remain, taking into account reporting from the expert panels. The IM report, the mining Authorisation and appropriate sections of the Proponent's Mining Management Plan would be publicly available.

The NT EPA is concerned that significant environmental impacts could occur as a result of a major incident, e.g. failure or overflow of the TSF or other events that may lead to uncontrolled release of contaminated water or tailings. To strengthen internal processes and ensure that these risks to the environment are recognised, minimised and would be appropriately prevented and managed, the NT EPA recommends three yearly reviews of critical controls for stability and seepage by the expert panels on all domains on the site. These reviews would enable the regulator to ensure critical controls are implemented that would most likely prevent such events.

The Proponent presented a preferred closure option involving: in-pit disposal of all reprocessed tailings and reactive waste rock over the last six years of mining; rapid filling of the pit void to create an isolated pit lake; and ultimately a flow-through lake connected to the McArthur River. While the NT EPA has reviewed the large amounts of information generated by the Proponent pertaining to these closure options, it is of the view that closure is not proposed for at least 20 years and therefore, judgements on the merits or otherwise of closure options are premature in the absence of comprehensive data on long term outcomes and the likelihood of improved technologies and more appropriate solutions to emerge over time. Even so, the NT EPA is firmly of the view that any option must meet the NT EPA's **overarching environmental outcome**.

The NT EPA considers that effective long term containment of mining waste, post-closure or following unforeseen closure, is essential to ensure protection of the environment, particularly the McArthur River. The NT EPA has recommended that mine closure planning be an integral part of mine planning and that progressive rehabilitation is undertaken according to an approved schedule during operations. This would lower the risk of environmental harm during and after the life of the Proposal including any period of care and maintenance. The NT EPA recommends the Mine Closure Plan be updated regularly and in cooperation with a Mine Closure Expert panel, involving broad stakeholder representation. The mining security bond required under the *Mining Management Act* should be revised based on the updated Mine Closure Plan, and independently assessed, to ensure the costs of rehabilitation and post-closure liabilities are not borne by the NT Government and the community, in the event of the Operator abandoning the site or becoming insolvent.

The Proponent has proposed adaptive management as a tool that could, if well designed and implemented, provide a framework for sound management and structured decision making to initiate changes in programs to achieve the required performance when evidence of problems appear. The NT EPA considers that adaptive management should be complemented by a strong regulatory regime. It is important that the processes include public scrutiny and engagement to ensure accountability. The NT EPA makes **Recommendations 28** with respect to adaptive management.

The NT EPA makes **30** recommendations as an outcome of the EIA of the Proposal. These recommendations are for the Proponent and decision-makers to consider with respect to any conditions of approval, future mine management plans, and in the execution of the proposed action.

The NT EPA is of the view that the Proposal, if implemented in accordance with the **overarching environmental outcome** and the recommendations of this Report, has good prospects of ameliorating an environmental problem at the mine, and as such, a 'no project' scenario is more likely to result in uncontrolled and unacceptable outcomes for the environment.

The NT EPA considers that, subject to the implementation of the recommendations in this Assessment Report and the commitments and safeguards listed by the Proponent in the EIS, the Proposal can be implemented and managed in a manner that is likely to meet the NT EPA's objectives and avoid significant or unacceptable environmental impacts and risks.

List of Recommendations

Recommendation 1

The Proponent shall ensure that the McArthur River Mine Overburden Management Project is implemented in accordance with all environmental commitments and safeguards:

- i. **identified in the final Environmental Impact Statement for the McArthur River Mine Overburden Management Project (draft Environmental Impact Statement, Supplement to the draft Environmental Impact Statement and additional information)**
- ii. **recommended in this Assessment Report 86.**

The Northern Territory Environment Protection Authority considers that all safeguards and mitigation measures outlined in the Environmental Impact Statement are binding commitments made by the Proponent.

Where there is an inconsistency between the commitments made by the Proponent and these recommendations, the recommendations will take precedence.

Recommendation 2

The Proponent shall provide written notice to the Northern Territory Environment Protection Authority and the responsible Minister if it alters or proposes to alter the McArthur River Mine Overburden Management Project and/or commitments, safeguards or mitigation measures in the Environmental Impact Statement in such a manner that the environmental significance of the action may have changed, in accordance with clause 14A of the Environmental Assessment Administrative Procedures.

Recommendation 3

The Proponent shall ensure that the commitments and safeguards listed in the EIS for the McArthur River Mine Overburden Management Project and recommended in this Assessment Report 86 are implemented in a manner and to the extent that ensures the health of the McArthur River is protected along its whole length at all times from mine related impacts. This is the overarching environmental outcome that is required to be achieved in respect of the Proposal and all future stages of the mine.

To ensure the protection of the McArthur River from mine related impacts, the Proponent shall ensure that the annual loads of lead and zinc discharged to the McArthur River in future years (July to June) do not exceed the loads discharged in 2017-2018, taking into account seasonal variations in rainfall, and subject to future annual load calculations.

The Proponent shall implement a monitoring program, developed in accordance with Recommendation 13, within six months of authorisation of the Proposal, to the satisfaction of the relevant regulator. The monitoring program shall quantify the annual loads of lead and zinc entering the main channel of the McArthur River and be used to assess whether or not the load limits specified herein have been met. A load summation shall be provided to the Independent Monitor for auditing at three yearly intervals.

The Proponent shall implement an Adaptive Management Plan, to be developed in accordance with Recommendation 28, to allow for management measures and interventions to be adapted if necessary to achieve this overarching environmental outcome.

Recommendation 4

The Proponent shall implement all stages of the Proposal to meet the NT EPA's overarching environmental outcome provided for in Recommendation 3 to the satisfaction of the relevant regulator. In doing so, the Proponent shall ensure:

- i. water quality in the McArthur River meets site-specific trigger values determined in accordance with ANZECC (2000) guidelines at appropriate monitoring locations determined in accordance with Recommendation 13
- ii. creeks on the mine site show long-term improving trends in water quality within 20 years after cessation of mining.

Recommendation 5

Approvals and decisions in relation to the Proposal shall include conditions that require the Proponent to calculate contaminant loads and contaminant concentrations entering creeks and the McArthur River using models that have been regularly reviewed and recalibrated.

Specific assumptions to be tested include but are not limited to:

- i. groundwater flow paths
- ii. attenuation of metals from mine-derived wastes.

Updated modelling shall use suitable site-specific data collected in the monitoring program. Models and modelling outputs, and the data collection programs to inform model updates, shall be reviewed at three year intervals by relevant independent panels appointed in accordance with Recommendations 8, 11 and 23,

and the outputs used to inform the Adaptive Management Plan, to be developed in accordance with Recommendation 28.

Recommendation 6

Approvals and decisions in relation to the Proposal shall include conditions that require an audit to be conducted of the Proponent's Quality Assurance / Quality Control procedures and waste rock identification and handling performance every three years and reported to the relevant independent panel and the relevant regulator.

Recommendation 7

The basal layer of the NOEF foundation shall be constructed with a compacted clay layer of at least 0.5 m thickness to limit seepage to groundwater during construction of the NOEF.

Recommendation 8

Approvals and decisions in relation to the proposal will include conditions requiring the Proponent to provide funding to establish and operate a panel of independent experts to:

- i. review every three years the outcomes of the Proponent's management program for the NOEF, including the stability, surface condition, internal temperature, reactions and seepage quantity and characteristics of the NOEF to ensure the overarching environmental outcome can be met
- ii. review NOEF runoff and seepage monitoring results, and in particular trends in the contaminant concentrations in groundwater, and loads entering creeks and the McArthur River
- iii. review the cover trial results, construction quality records, critical controls, stability assessments, cover performance and performance of progressive rehabilitation of the NOEF.

The panel shall provide a report every three years to the relevant regulator and the Independent Monitor and the report made available to the Proponent, government agencies, the Community Reference Group and the public.

The panel is to be formed:

- iv. with an independent chair, appointed by the responsible Minister in consultation with the Minister for Environment and Natural Resources
- v. on the advice of the Department of Environment and Natural Resources, the Department of Primary Industry and Resources, and the Proponent.

Terms of Reference for the panel shall set out the terms for roles and responsibilities, membership, timeframe for commencement and scope, reporting obligations and transparency and accountability. The Terms of Reference shall be finalised by the responsible Minister, in consultation with the Minister for Environment and Natural Resources acting on advice from the NT EPA, within three months of authorisation of the Proposal.

The structure of the panel and its Terms of Reference shall be reviewed by the Responsible Minister, in consultation with the Minister for Environment and Natural Resources every six years from the date the Terms of Reference are finalised.

Recommendation 9

Approvals and decisions in relation to the Proposal shall include conditions that require the Proponent to implement a groundwater interception and recovery system for the NOEF. The system is to be designed to:

- control seepage to Barney Creek diversion and the McArthur River over the life of the NOEF to as low as reasonably practicable
- achieve a recovering trend in the Barney Creek diversion and the old McArthur River channel water quality within 20 years of cessation of mining.

The system design and performance shall be reviewed by the independent panel, appointed in accordance with Recommendation 8, and approved by the relevant regulator/s.

Recommendation 10

Approvals and decisions in relation to the Proposal shall include conditions that require the Proponent to undertake constructability tests for geosynthetic liner cover options, including a geosynthetic liner /compacted clay layer combination, and monitor the options on rehabilitated stages of the NOEF to determine all relevant performance parameters including:

- slope stability during extreme events
- cover performance as a result of heat effects
- tolerance of the geosynthetic liner to expected differential settlement
- veracity of cover longevity predictions
- likely long-term maintenance requirements.

Reporting of trial results and monitoring outcomes shall be provided every three years to the relevant independent panel and the Community Reference Group for review, and shall be audited by the Independent Monitor. Outcomes of trials and monitoring shall be used to inform the Adaptive Management Plan, to be developed in accordance with Recommendation 28, and the Closure Plan for the mine.

Recommendation 11

Approvals and decisions in relation to the proposal will include conditions requiring the Proponent to provide funding to establish and operate a panel of independent experts to:

- i. review every three years the outcomes of the Proponent's management program for the TSF including the berm stability, risk of overtopping, seepage and other aspects of the TSF that could impact on site water quality and the McArthur River, including the risk of catastrophic failure of any component of the TSF, to ensure that the overarching environmental outcome can be met
- ii. review TSF seepage monitoring results and the appropriateness of the monitoring program.

The panel shall provide a report every three years to the relevant regulator and the Independent Monitor and is made available to the Proponent, government agencies, the Community Reference Group and the public.

The panel shall be formed:

- iii. With an independent chair, appointed by the responsible Minister in consultation with the Minister for Environment and Natural Resources.
- iv. on the advice of the Department of Environment and Natural Resources, the Department of Primary Industry and Resources, and the Proponent.

Terms of Reference for the panel shall set out the terms for roles and responsibilities, membership, timeframe for commencement and scope, reporting obligations and transparency and accountability. The Terms of Reference shall be finalised by the responsible Minister, in consultation with the Minister for Environment and Natural Resources acting on advice from the NT EPA, within six months of authorisation of the Proposal.

The structure of the panel and its Terms of Reference shall be reviewed by the Responsible Minister, in consultation with the Minister for Environment and Natural Resources every six years from the date the Terms of Reference are finalised.

Recommendation 12

As soon as practicable after cessation of mining, tailings and other contaminated earthen materials from the Tailings Storage Facility shall be deposited in the mine pit void using contemporary best-practice placement techniques, then protected with a water cover. Tailings shall preferably be reprocessed before in-pit disposal.

The intention of these measures is to protect the McArthur River water quality and aquatic ecosystems from surface or groundwater contamination consistent with the NT EPA's overarching environmental outcome in Recommendation 3. Any requirement to vary these measures will need approval from the relevant regulator and notification to the NT EPA in accordance with Recommendation 2. These measures should only be varied on the basis of further information to inform leading practice.

Recommendation 13

Approvals and decisions in relation to the Proposal shall include conditions that require the Proponent to conduct a review and synthesis of all water monitoring programs (groundwater and surface water) and implement a revised program that is capable of identifying and quantifying impacts of mining activities and their trends on the environmental values and beneficial uses of the McArthur River to measure performance against the NT EPA's overarching environmental outcome in Recommendation 3.

The revised water monitoring program shall:

- i. quantify loads of lead and zinc entering the McArthur River each year
- ii. quantify impacts to water quality and trends in groundwater and surface water at appropriate points including upstream and downstream of the mine to determine that objectives and targets are being met, including the effectiveness of source control to reduce loads as low as is reasonably practicable

- iii. develop appropriate future trigger values for waterways on the mine site and the McArthur River in accordance with the ANZECC 2000 Guidelines. In the interim, the trigger values in the most current WDL shall be used.

The review and revision of the water monitoring program shall be conducted to the satisfaction of the relevant regulator/s and the NT EPA as part of the broader monitoring review provided for in Recommendation 27 and incorporated into the authorised Adaptive Management Plan.

The results of the monitoring program are to be reported by the Proponent to the relevant regulator and audited by the Independent Monitor every three years. The monitoring report together with the Independent Monitor's audit report shall be made available to government agencies, the Community Reference Group and publicly on the Proponent's and relevant regulators' websites.

Recommendation 14

Approvals and decisions in relation to the Proposal shall include conditions that require the Proponent to prepare and implement a research and investigation program designed to determine the chronic and acute impacts to biota of mine-derived contaminants using recognised and accepted ecotoxicological testing. The program shall be designed to integrate with the monitoring program to be developed in accordance with Recommendation 15. Results of the program shall be used to inform trigger criteria in the Adaptive Management Plan.

The program shall be prepared and implemented to the satisfaction of the Department of Environment and Natural Resources, and the Australian Government Department of the Environment and Energy.

Recommendation 15

Approvals and decisions in relation to the Proposal shall include conditions that require the Proponent to implement an aquatic ecosystem monitoring program based on improved understanding of aquatic ecosystems in the McArthur River including flow requirements and available Dry season habitat. The program shall be designed to assess impacts from the mine on:

- i. water levels in refuge pools/waterholes, upstream and downstream of the mine, including in the McArthur River diversion channel
- ii. water quality in refuge pools/waterholes in the Dry season
- iii. the health of aquatic biota in the McArthur River using non-lethal sampling methods.

The monitoring program shall be prepared and implemented to the satisfaction of the Department of Environment and Natural Resources, and the Australian Government Department of the Environment and Energy.

The monitoring program shall be designed to integrate with a revised monitoring program provided for in Recommendation 27 and incorporated into the Adaptive Management Plan, to be developed in accordance with Recommendation 28

The results of the monitoring program are to be reported by the Proponent and audited by the Independent Monitor every three years. The monitoring report together with the Independent Monitor's audit report shall be made available to government agencies and the community on the Proponent's and relevant regulators' websites.

Recommendation 16

Approvals or decisions in relation to the Proposal, shall include conditions that require the Proponent to conduct all works in accordance with a valid Certificate issued in accordance with the *Northern Territory Aboriginal Sacred Sites Act*.

Recommendation 17

Prior to any approvals for the Proposal, the Proponent and the responsible Minister shall consult with the Minister for Tourism and Culture on an alternative design of the NOEF that would preserve archaeological site MRM4. Any alternative design of the NOEF must achieve the same environmental outcomes as the currently proposed NOEF, taking into consideration the recommendations in this report.

Recommendation 18

Approvals or decisions in relation to the Proposal, shall include conditions that require the Proponent to demonstrate to the responsible Minister, and the AAPA or the Minister for Tourism and Culture (where relevant), that it has undertaken a thorough process to identify, inform and consult with the appropriate custodians and traditional owners with an interest in lands that would be or may be affected by the Proposal.

Recommendation 19

Approvals and decisions in relation to the Proposal shall include conditions that require the Proponent to monitor sulfur dioxide within 1 km downwind of the NOEF, to the satisfaction of the NT EPA and relevant regulator. The objective of this monitoring program should be to identify any increase in sulfur dioxide emissions from the NOEF and any potential air quality risk to human health outside the MRM leases for all stages of the Proposal.

The monitoring program shall be reviewed in accordance with Recommendation 27 and incorporated into the Adaptive Management Plan, to be developed in accordance with Recommendation 28.

The results of the monitoring program are to be reported by the Proponent to the relevant regulator and audited by the Independent Monitor every three years. The monitoring report together with the Independent Monitor's audit report shall be made available to government agencies, the Community Reference Group and publicly on the Proponent's and regulator's websites.

Recommendation 20

Approvals and decisions in relation to the Proposal shall include conditions that require the Proponent to:

- i. continue a monitoring program, to the satisfaction of the NT EPA on advice of the Chief Health Officer, to determine if aquatic fauna obtained from any reach of the McArthur River is safe to eat during all stages of the Proposal
- ii. publicly report the results of monitoring, including at appropriate locations in the region
- iii. maintain signage at waterways within the MRM site advising that fishing and harvesting of aquatic food species is prohibited, until the waterways recover and the risk of contamination from consumption of this aquatic fauna is negligible.

Recommendation 21

Approvals and decisions in relation to the Proposal shall include conditions that require the Proponent to develop a non-lethal monitoring program for sawfish and from the results, define a specific (measurable and time-bound) threshold for a significant decline in sawfish movement (based on data) that would trigger investigation and implementation of management measures. This threshold is to be developed to the satisfaction of the Australian Government Department of the Environment and Energy and the Department of Environment and Natural Resources, within 12 months of authorisation of the Proposal.

Recommendation 22

Approvals and decisions in relation to the Proposal shall contain conditions that require environmental objectives to be established and achieved in case the mine site enters into care and maintenance. Environmental objectives should be reviewed by the relevant independent panel/s and approved by the relevant regulator/s after consultation with the Community Reference Group, custodians and traditional owners.

Recommendation 23

Approvals and decisions in relation to the proposal will include conditions requiring the Proponent to provide funding to establish and operate a panel of independent experts to:

- i. review and advise on the development of closure and care and maintenance strategies for mine site domains, and the Proponent's trajectory towards achieving agreed closure objectives
- ii. review the risk of potential catastrophic failure of the mine levee wall and the McArthur River diversion channel in view of future closure objectives.

The panel shall be formed:

- iii. with an independent chair, appointed by the responsible Minister in consultation with the Minister for Environment and Natural Resources
- iv. on the advice of the relevant regulator/s and the Proponent.

The panel shall conduct a rolling 3-5 year review of the mine closure plan to assess the trajectory of closure options for MRM site domains and provide a report to the relevant regulator and the Independent Monitor that is made available to the Proponent, government agencies, the Community Reference Group and the public.

Terms of Reference for the panel shall set out the terms for roles and responsibilities, membership, timeframe for commencement and scope, reporting obligations and transparency and accountability. The Terms of Reference shall be finalised by the responsible Minister, in consultation with the Minister for Environment and Natural Resources acting on advice from the NT EPA, within 12 months of authorisation of the Proposal.

The structure of the panel and its Terms of Reference shall be reviewed by the Responsible Minister, in consultation with the Minister for Environment and Natural Resources every six years from the date the Terms of Reference are finalised.

Recommendation 24

An independent third-party assessment of the security that must be provided by the Proponent or Operator for rehabilitation of the Authorised activities at the McArthur River Mine site shall be conducted by a qualified person approved by the responsible Minister. The security amount shall be sufficient to secure the site in a manner that meets the NT EPA's overarching environmental outcome. The independently calculated amount and final amount of the security shall be published on the relevant regulator's website with any variation between the amounts explained.

The security amount shall be reassessed every three years if an assessment of the security amount by the regulator has been undertaken during that time in accordance with the Authorisation for the McArthur River Mine.

Recommendation 25

The Mining Management Plan (overview and environmental management section) and the Authorisation for the McArthur River Mine Overburden Management Project shall be made available to the public on the relevant regulator's website and in hard copy at an appropriate location in Borroloola (e.g. Borroloola Public Library).

Recommendation 26

Approvals and decisions in relation to the Proposal shall include conditions that require a Community Reference Group to be established that has the following roles:

- i. communicate the mine's performance to the local and broader NT community
- ii. advise on the most appropriate method for the Proponent to report information that is required to be made publicly available
- iii. provide a structured forum for review and discussion in setting environmental objectives for adaptive management, operation, care and maintenance, mine closure and the evaluation and costing of mine closure options
- iv. provide a forum for discussing economic and social post-mining impacts
- v. translate technical information into communication that is readily understood by the community, clear statements of outcomes to be achieved and progress in achieving them for both operational and closure matters.

The Group shall be chaired by an independent person appointed by government, who is held in high regard in civic life and has expertise in taking the community interests into account and experience in the position of chair.

The Group shall comprise members who represent the local community and broader Northern Territory community, as well as key stakeholders, particularly custodians and Traditional Owners.

A Terms of Reference for the Group shall be developed to the satisfaction of the NT EPA and agreed by the relevant regulator/s and the Department of the Chief Minister. Details regarding the establishment of the Community Reference Group, including roles and responsibilities, membership, timeframe for commencement

and scope, reporting obligations and accountability should be decided within 12 months of all approvals being received for the Proposal.

The structure of the Group and its Terms of Reference shall be reviewed every six years from the date the Terms of Reference are finalised.

Recommendation 27

Approvals and decisions in relation to the Proposal shall include conditions that require the Proponent to conduct a complete review and synthesis of all monitoring programs that assess impacts of mining activities on the environmental values and beneficial uses of the McArthur River, in accordance with the NT EPA's overarching environmental outcome in Recommendation 3. The revised monitoring program shall be reviewed by the independent panel/s and Independent Monitor within nine months of authorisation of the Proposal, and then approved by the relevant regulator/s.

The revised monitoring program shall be incorporated into the Adaptive Management Plan.

Recommendation 28

Approvals and decisions in relation to the Proposal shall include conditions that require the Proponent to prepare an Adaptive Management Plan that includes the following key elements:

- i. clear, measurable environmental objectives for all significant environmental risks and potential impacts
- ii. measureable performance indicators to show that objectives are on target to be met
- iii. pre-determined triggers to warn of potential for performance indicators to be exceeded, as informed by monitoring
- iv. pre-determined, realistic and achievable contingency interventions to maintain performance indicators if triggers are consistently exceeded
- v. clearly defined management measures/actions that are capable of being implemented in a timely way to meet performance indicators and environmental objectives
- vi. monitoring in accordance with relevant Recommendations in this Report to determine whether management measures are effective and to inform the need for adjustments to management measures or need for alternatives
- vii. a continual feedback system to ensure appropriate actions are initiated when triggered and environmental objectives are always being met
- viii. continual development of new management actions as required based on knowledge gained from experience at the site and elsewhere across industry.

All key elements should be auditable. Performance indicators, triggers and actions in the Adaptive Management Plan are aimed at ensuring the specified objectives are met.

Before approvals or decisions are given or made for the Proposal, the Adaptive Management Plan shall be reviewed by the Independent Monitor or an appropriately qualified, independent third party, and the review findings and plan

provided to relevant regulator/s, the NT EPA, the Community Reference Group and be made available to the public.

Recommendation 29

The Authorisation for the Proposal must provide for approval, implementation and review of the Adaptive Management Plan. To ensure clarity and enforceability, conditions of the Authorisation must:

- i. clearly set out the required management objectives and performance indicators
- ii. provide clarity on the triggers for changes to management actions, and responsibility and evidentiary basis for decision-making
- iii. establish the timeframe for initiation of certain actions if triggers are exceeded, including decisions to discontinue an activity and clarify responsibility and evidentiary basis for decision-making
- iv. establish a process for adjusting triggers that includes the regulator
- v. establish transparent monitoring, reporting and review requirements
- vi. establish processes to ensure transparency and stakeholder engagement in Adaptive Management Plan design and implementation
- vii. set out the mechanism for periodic review and approval of amendments to the plan.

The Adaptive Management Plan and its implementation must be reviewed by the Independent Monitor every three years, with the outcomes of the review made available to the relevant regulator/s, the NT EPA, the Community Reference Group and the public.

Recommendation 30

Where trends indicate that performance indicators and environmental objectives will not or are unlikely to be met by implementing the adaptive management plan, the NT EPA must be notified of any resultant changes to the Proposal required under clause 14A of the Environmental Assessment Administrative Procedures.

1 Introduction

1.1 Purpose of this report

This Assessment Report (this Report) has been made in accordance with the *Environmental Assessment Act* (EA Act) and the Environmental Assessment Administrative Procedures (EAAP). This report completes the Northern Territory Environment Protection Authority's (NT EPA) assessment of the McArthur River Mine Overburden Management Project (the Proposal).

The McArthur River Mine is an existing mine that is authorised to continue operating under an approved Mining Management Plan (MMP) covering the operating period 2015 to 2018. The Proposal comprises a number of components of the mine proposed to be altered from the current Authorisation in response to a revised system of waste rock classification that requires some significant changes to management practices at the site.

The purpose of this Report is to ensure that matters affecting the environment to a significant extent as a result of the Proposal are fully examined and reported. The NT EPA provides this Report to the Northern Territory Minister for Environment and Natural Resources (the Minister). The Minister is required to provide a copy of this Report to the Minister for Primary Industry and Resources (the responsible Minister), together with any written comments made by the Minister in relation to this Report. This Report is not an environmental approval, although it contains comments, suggestions and recommendations for consideration in decisions made by the responsible Minister, including whether to authorise the Proposal in accordance with the Report and imposing conditions for construction, operation and closure and any other decision for the life of the mine (LOM).

This report is also provided to the Australian Government Minister for the Environment and Energy (Australian Government Minister) in accordance with an accredited assessment process under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) to assist with the consideration of an approval decision under the EPBC Act (by the relevant delegate).

1.1.1 Reasons for assessment

McArthur River Mining Pty Ltd, a Glencore company (the Proponent), submitted a Notice of Intent (NOI) for the Overburden Management Project (the Proposal) to the NT EPA on 27 June 2014. The basis for submitting the NOI was the reclassification of waste rock following the environmental assessment and approval of the McArthur River Mine (MRM) Phase 3 Development proposal in 2013 (refer Section 1.3.1). The classification system used by the Proponent while operating the open cut mine did not match the actual characteristics of the rock being mined.

The new classification divides waste rock into benign and a range of non-benign (problematic) categories. Unlike the previous waste rock classification, the updated classification system accounted for non-acid forming (NAF) waste rock that would likely produce metalliferous drainage under circum-neutral conditions and saline drainage, as well as potentially acid forming (PAF) and highly reactive material.

The updated classification system forecast that problematic waste rock (having the potential to cause acid and/or metalliferous and/or saline drainage (AMD)), could account for up to 89% of the total waste material in the 2013 - 2018 mining period, in contrast to the 25% of problematic waste rock predicted in the Phase 3 EIS.

This increase in the proportion of waste rock with the potential to cause significant environmental impacts, if not effectively managed, represented a major increase in environmental risk from mining at the MRM site. The updated classification system and improved understanding of environmental risk required the Proponent to reconsider its approach to the handling, management and permanent disposal of waste rock. The previously approved waste rock dumps were not designed for the disposal of the high proportion of problematic re-characterised waste rock that was actually mined, and this became widely evident in 2014 when the Northern Overburden Emplacement Facility (NOEF) waste rock dump began emitting smoke and sulfur dioxide, giving the appearance of being “on fire”.

The NOI for the Proposal presented the Proponent’s intention to obtain approval for a redesign of the NOEF and other waste rock dumps (overburden emplacement facilities) at MRM.

On 10 July 2014 the NT EPA decided that the waste rock handling and disposal conditions previously assessed and approved in the Phase 3 project had been altered in such a manner that its environmental significance had changed, and that assessment at the level of an EIS was required.

1.1.2 Scope of assessment

The Proponent is currently authorised to continue mining under an approved MMP covering the operating period 2015 to 2018. This assessment looks at the Proposal including all aspects of the operation that require alteration as a result of the updated waste classification and that have the potential to have a significant impact on, or present additional risks to, the environment. In addition, the NT EPA has assessed the cumulative effects of existing operations and the change in rock characteristics on key environmental factors in Section 5 of this Report, including inland water quality, hydrological processes, aquatic ecosystems, social, economic and cultural surroundings and human health (including air quality). The scope of the Proposal that is being assessed is further discussed in Section 2.2.

The NT EPA assessed the potentially significant environmental impacts and risks associated with the Proposal in line with the NT EPA factors and objectives and in accordance with the requirements under the EA Act. The matters relating to the environment that the NT EPA considered necessary to be dealt with in the EIS for the Proposal were identified in the Terms of Reference (NT EPA, 2014) in accordance with clauses 8(3) to (6) of the EAAP. Those factors that were not identified as requiring further impact assessment and not required to be dealt with in the EIA are summarised at Appendix 3 of this Report.

As the Proposal was determined to be a controlled action under the EPBC Act, the potential impacts and risks to Matters of National Environmental Significance (MNES) have been included in the scope of this assessment as outlined in section 6 of this Report.

1.1.3 Information before the NT EPA

In making this Report, the NT EPA had regard to:

- the Notice of Intent
- the Terms of Reference
- the draft EIS
- the Supplement to the draft EIS

- additional information provided by the Proponent
- comments from NT Government agencies on the draft Terms of Reference, draft EIS and Supplement to the EIS
- comments from the public on the draft Terms of Reference and the draft EIS
- review of the draft EIS and Supplement by ERIAS Group
- plans, conservation advice and policies prepared under or for the purposes of the EPBC Act
- reports of the MRM Independent Monitor
- technical and other reports which are noted in the References (section 9) to this Report.

1.2 Approval and regulatory framework

The Proposal will require approval and regulation by the Northern Territory (NT) Government and the Australian Government. The framework for approval and regulation of the Proposal is provided in Chapter 2 of the draft EIS and is summarised below, with an emphasis on the obligations and requirements of the NT Government.

The NT EPA provides this Report to the Minister. The Minister is required to provide a copy of this Report to the responsible Minister, together with any written comments made by the Minister in relation to this Report. If the Minister makes a comment in relation to this Report, the Minister must comply with reporting obligations to the NT EPA, under section 8B of the EA Act.

1.2.1 Primary approvals required

The *Mining Management Act* is the primary legislation for authorising and regulating mining activities in the Territory. The responsible Minister, taking into consideration this Report, will decide whether to grant authorisation for the Proposal under the *Mining Management Act* and if so, the conditions that may be applied.

Section 8A(2) of the EA Act requires the responsible Minister to give the NT EPA notice of the decision as soon as practicable, but within seven days, after making the decision. Alternatively, if the decision by the responsible Minister is contrary to this Report, the responsible Minister must comply with reporting obligations to the NT EPA and the Legislative Assembly in accordance with section 8A(3) of the EA Act.

This report is also provided to the Australian Government Minister to assist with the making of a decision for an approval under the EPBC Act (by the relevant delegate).

The provision of this Report to the Minister marks the completion of the examination of the EIS by the NT EPA. The EIS and supporting documents can be viewed on the Proposal page on the NT EPA website at: <https://ntepa.nt.gov.au/environmental-assessments/register/mcarthur-river-mine>

1.2.2 Current approvals (*Mining Management Act*)

The Proponent is currently authorised to continue mining and is operating in accordance with an approved MMP covering the operating period 2015 to 2018. The Proponent's current MMP is the *Sustainable Development Mining Management Plan 2013-2015 Volumes 1 and 2* dated 3 March 2015 and approved by the responsible Minister under the MM Act on 23 December 2015.

There have been a number of amendments to the 2013-2015 MMP approved by the responsible Minister or the Department of Primary Industry and Resources (DPIR), as delegate, associated with the following activities:

- Tailings storage facility (TSF) Cell 2 Raise 3 (Detailed Design Report – Revision 2, April 2015)
- Southern Perimeter Run-off Dam (SPROD) Lining Upgrade (Design Report, August 2016)
- TSF Cell 2 Raise 4 (Detailed Design Report – February 2017)
- Central west overburden emplacement facility (CWNOEF) and northern overburden emplacement facility (NOEF) West D Amendment – construction in accordance with Phase 3 methods (March 2016)
- Western Perimeter Run-Off Dam (WPROD) and Western Surface Water Management Design Update
- Lead Sulfate Filter Plant – Design Basis - Attachment D of Additional information lodged 01/05/2015.

The Proponent has a current Variation of Authorisation as of 29 November 2017. The Authorisation does not have a termination date but is subject to the submission and approval by the responsible Minister of periodic MMPs.

1.2.3 Current approvals (other legislation)

The Proponent holds a Waste Discharge Licence (WDL174) under the *Water Act* for the discharge of waste water from two authorised discharge points on the mine site. The quality of these discharges is monitored at a compliance point in the McArthur River downstream of the mining lease. The monitoring results are summarised in this Report.

The Proponent holds several authority certificates issued in accordance with the *Northern Territory Aboriginal Sacred Sites Act* (NTASS Act), including one (C 2004/084) that limits the height of the waste rock dump to 80 metres.

1.2.4 Environment Protection and Biodiversity Conservation Act 1999

The Proposal (EPBC 2014/7210 - McArthur River Redesign & Reconfiguration of the Northern Overburden Emplacement Facility, NT) is a controlled action and requires assessment and approval under the EPBC Act before it can proceed. The then Australian Government Minister for the Environment agreed to accredit the assessment process under the EA Act for the purposes of assessing the Proposal. This Report will be provided to the Australian Government Minister for Environment and Energy and it will inform the considerations for a decision under the EPBC Act.

1.3 Background to the Proposal

1.3.1 History of existing mine

The zinc-lead-silver deposit that hosts MRM was discovered by a survey party from Mount Isa Mines (MIM) in 1955. In 1992, MIM joined with the Japanese consortium ANT Minerals to develop the mine. McArthur River Mining Pty Ltd was formed to operate the mine on behalf of the joint venture owners.

In 2003 Xstrata purchased MIM Holdings Limited, acquiring a majority (70%) share in McArthur River Mining Pty Ltd. Xstrata became the full owner of McArthur River Mining Pty Ltd in September 2005 when it acquired the remaining share from ANT Minerals. In May 2013, Glencore plc merged with Xstrata and Glencore plc became the owner of McArthur River Mining Pty Ltd, the operator of MRM.

Following the completion of an EIS and approval by Government, MRM commenced in 1994 as an underground mine with the assumption that it would last for 20 years. The underground mine ceased operating in 2005.

The Phase 2 expansion changed the underground operation to an open cut operation to secure the long-term viability of the operation, which was becoming uneconomical due to reduced output rates and safety issues. Phase 2 increased the mining rate from 1.6 million tonnes (Mt) per year to 1.8 Mt per year (Mt/y). The proposal included diverting Barney Creek and a 5.5 km length of the McArthur River around the mineral resource, establishing a flood protection bund around the pit area, and constructing above-ground overburden emplacement facilities for waste rock disposal. Total reserves increased to 43 Mt and the proposed mine life extended to 25 years.

The Phase 3 Development Project was assessed by the Department of Natural Resources, Environment, the Arts and Sport in 2012 and approved in 2013 (draft EIS Chapter 1). Phase 3 involved an approximate doubling of the open pit surface area and depth (increased footprint from 145 ha to 210 ha and increased depth from 210 m to 420 m). The mining rate also increased from 2.5 Mt/y to 5.5 Mt/y of ore and production of zinc-lead concentrate increased from 360 000 Mt/y to 800 000 Mt/y), and extended the mine life by nine years, to 2036.

The history of the mine has been complex and at times, contentious, with opposition due to concerns about environmental impacts and social implications of the mine. This history is summarised at Appendix 1.

1.3.2 Existing Socio-economic environment

The Proponent has been operating since 1992, influencing the socio-economic environment of the NT and the local region. Broad economic benefits from MRM have been in the form of contribution to NT Gross State Product (GSP), payment of government taxes and royalties, and employment, as outlined below. MRM operations have also influenced the way people live and interact, particularly in the local region, a remote area of the NT that has limited development and economic activity.

A measure of the Proponent's contribution to GSP is not publicly available, but it is apparent that the mining industry as a whole is a significant contributor to the NT's GSP, contributing 12-13% of the GSP for at least the last ten years (ABS, 2017c). MRM is one of nine authorised and producing mines in the NT (DPIR, 2018b). In 2016-17 the value of MRM's production was \$650 million, about 18% of the value of total mining production in the NT (DPIR, 2018a).

In addition, the Proponent would have contributed to government revenue via taxes and royalties. Payroll taxes are received annually by the NT Government, proportional to the number of staff and their salaries. The NT EPA estimates that, with current staff numbers, MRM payroll tax would be up to about \$2 million per annum (estimate based on draft EIS table 12-18 and current employment numbers).

Mineral royalty payments also contribute revenue to the NT Government. To date, royalty payments from the Proponent have been infrequent – the NT EPA is aware of

only one royalty payment in 23 years of operation¹ (MRM, 2007). This infrequency is at least partly due to the profit-based royalty system, that will change to a minimum value based mining royalty in mid-2019 (NTG, 2018c). Company taxes would have been received by the Australian Government as a portion of parent company Glencore's tax payments.

The Proponent has also contributed to the NT economy by the employment of staff, some of whom have moved to the Territory to work for MRM. The Proponent had 399 direct employees in 2018, and 54% of these were resident in the NT. Further, the Proponent has contributed flow-on economic benefits through its supply and service providers, who employ their own staff and contribute to the economy in other ways. Resident MRM and contractor employees further contribute indirectly to the NT and Australian economy by the purchase of local goods and services including education, health services, transportation, accommodation, food and entertainment.

Locally, the Proponent has influenced both the way people live and interact and their attitudes towards MRM. The Proponent reports many positive social contributions to the regional community, largely centred on Borroloola. These include sponsorship of social and cultural events and facilities in the region (e.g. Borroloola Rodeo, fishing competitions at King Ash Bay and construction of the Borroloola swimming pool). The Proponent contributes to infrastructure and services in the local Borroloola area that are of benefit to the regional community, including flights to the region, food transport services and an emergency response team. The Proponent reported that it employs 37 Borroloola residents in 2018 (additional information), which is 9% of staff and about 5% of the Borroloola population aged 15 and over (based on 2011 census data; draft EIS Appendix Z table 5). The Proponent also reported that in 2018 indigenous employment is at the target of 20% of the workforce (additional information).

The Proponent established a Community Benefits Trust (CBT) in 2007 to enable MRM to financially contribute to the local community. In its first eleven years, MRM's CBT contributed \$14 million to 93 separate projects (MRM CBT, 2018). The Proponent reports that it also contributes to the local economy by engaging with local and regional businesses (draft EIS, p 12-24) through their local procurement program.

An example benefit from the Proponent's CBT is the contribution of \$1 million in 2011 for three years of supporting pathways to education and training for students (draft EIS table 12-9). Not all stakeholders consider that benefits previously predicted by the Proponent have been effectively delivered to the local community. Local residents Green and Hoosan (2017) claim that there have been "*so many broken promises – that's why we can't trust them no more... Every meeting, we've been asking for our mob to be trained up in monitoring and rehabilitation jobs but nothing happens...*" The NT EPA acknowledges the submissions received during public exhibition of the draft EIS, reporting concern and distress. These are further discussed in Section 3.1.

¹ Royalty payments received by the NTG are not publicly disclosed, however the Proponent reported that \$13.06 million in royalties were paid in 2007 due to high commodity prices (MRM, 2007).

1.3.3 Environment condition at existing mine and surrounds

This section of the report evaluates the current condition of the environment, as a basis for quantifying and assessing future potential impacts of the Proposal. The most significant environmental issue at MRM is the potential for AMD to be generated with potential for onsite and downstream impacts to groundwater and terrestrial and aquatic ecosystems via changes to surface water quality (IM, 2017).

Currently, surface water is monitored at 32 river and stream locations within and in the vicinity of the mine site, and at 55 other sites (water storages and sumps). EcoMetrix (2017) reviewed the monitoring program and concluded that monitoring locations have been strategically placed along the McArthur River, Barney Creek, Surprise Creek, Emu Creek, and the Glyde River to capture background concentrations and influences outside the mine (control sites and upstream sites), potential influences from the mine including discharges (midstream and downstream sites), potential influences of the constructed channels in the McArthur River and Barney Creek (channel sites), and water quality at the downstream compliance station specified in the Waste Discharge Licence (WDL). Overall the surface water monitoring program is able to detect constituents in surface water near and downstream of the NOEF. The program is able to determine the efficacy of risk management measures in place at the NOEF (e.g. PRODs) in intercepting constituents from entering the receiving surface waters.

A review of monitoring sites concluded that the existing monitoring network and sampling frequency was more than adequate to assess the effects of the mining operation on surface water on and off site (EcoMetrix, 2017).

Appendix U of the EIS presents a detailed summary of existing water quality in the McArthur River, Barney Creek and Surprise Creek. The data show that the concentrations of lead, zinc, cadmium and copper are well within the trigger values specified in the WDL for protection of aquatic organisms. Aluminium concentrations are occasionally elevated upstream and downstream of the mine due to natural runoff from the catchment. Salinity (measured by electrical conductivity) and sulfate concentrations are higher in surface waters adjacent to and downstream of the mine, and this is attributed by the NT EPA to runoff and seepage from the mine.

The Independent Monitor report for 2017 concluded that “the results from the monitoring program demonstrate a relatively high level of success in terms of compliance with WDL discharge requirements, as summarised in Table 4.6” (IM, 2017).

The Proponent also has a comprehensive network of groundwater monitoring bores on the site, a sediment monitoring program and extensive biological monitoring programs. Some results from the monitoring bores are presented later in this Report.

It is, however, a concern to the NT EPA that there is no analysis of trends in water quality or environmental conditions in any of the documentation provided by the Proponent’s EIS, reports by multiple (and overlapping) consultancies to review monitoring programs, or government agencies.

Appendix U of the EIS presents modelling projections of future water quality which indicate no increase in monthly lead or zinc concentrations leaving the site. The model predictions are not correlated to past trends in water quality and do not show the loads of key contaminants of concern (CoC, particularly lead and zinc) entering the McArthur River now and in the future.

On analysis of the available data, the NT EPA has found no evidence of significant impacts on water quality or aquatic life in the McArthur River downstream of the mine. The NT EPA notes that revegetation and rehabilitation of the riparian zone along the McArthur River diversion channel is improving and will play an important role in restoring ecological function to this section of the river. The Proponent is encouraged to continue and if possible accelerate this program. Impacts to water quality and terrestrial and aquatic habitats and biota (from AMD), and air quality (from sulfur dioxide and dust), are generally restricted to the mine site at present. There is the potential for future adverse off-site impacts to occur as a result of the Proposal.

In considering the condition of the existing environment, the NT EPA has focussed on aspects relating to the sources and pathways of impacts on water quality, as these are key to understanding potential impacts on receptors in the broader environment.

1.3.3.1 Existing mine

The three principal MRM domains are the key potential sources of AMD (IM, 2017). Operationally, a water management system (WMS) controls and manages contaminated water between sources across the three domains and the receiving environment to achieve the Proponent's water quality objectives (Section 5.1.2) and maintain compliance with the Waste Discharge Licence trigger levels at a monitoring compliance site in the McArthur River, SW11.

For this section of the report, the existing mine is divided into the MRM site in three domains (Figure 1):

- NOEF domain draining to Surprise Creek and the Barney Creek diversion
- tailings storage facility (TSF) domain draining to Surprise Creek and Little Barney Creek (diverted), and then to Barney Creek diversion
- open pit domain; bounded by the Barney Creek diversion and the McArthur River diversion and old McArthur River channels.

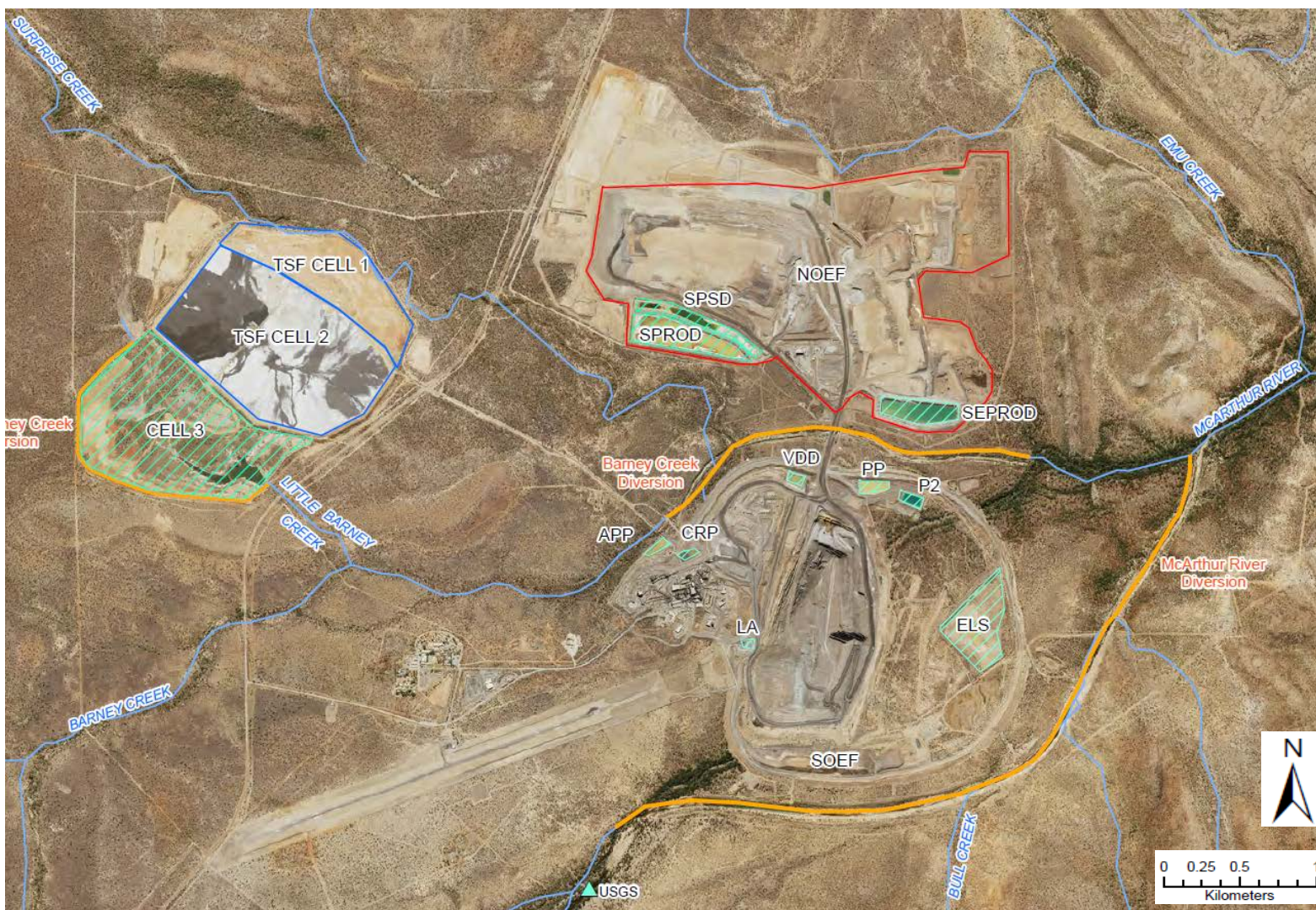


Figure 1: MRM site in 2016 showing the TSF, NOEF, and the open pit. The McArthur River flows towards the north-east, bypassing the open pit via the McArthur River diversion. Barney Creek has been diverted to the north of the open pit, incorporating the flows of Surprise Creek and entering the old channel of the McArthur River before joining with the active McArthur River channel. Source: Ecological Australia (2017)

In reporting on the existing environmental condition, the NT EPA draws on the Proponent's classification of mining waste materials (Table 1) and modelled contaminants of concern (CoCs) (Table 2).

Table 1: Updated classification of MRM mining waste materials in order of increasing potential for environmental impact (source: draft EIS Chapter 6). Section 1.1.1 outlines the reasons for the updated classification. High/low capacity indicates the acid consumption capacity of the material.

Previous classification	Updated Classification	Acronym
non-acid-forming (NAF)	low salinity non-acid-forming (high capacity)	LS-NAF(HC)
	metalliferous saline non-acid-forming (high capacity)	MS-NAF(HC)
	metalliferous saline non-acid-forming (low capacity)	MS-NAF(LC)
potentially acid-forming (PAF)	potentially acid-forming (high capacity)	PAF(HC)
	potentially acid-forming (reactive)	PAF(RE)

Table 2: Contaminants of concern (CoCs) used by the Proponent in groundwater and surface water modelling at MRM and downstream (primary source: draft EIS section 8.1.3.4).

CoC/s	Reason/s for concern
sulfate	<ul style="list-style-type: none"> primary indicator of mine waste reactivity as it is the dominant anion generated by oxidation of sulfidic waste rock its plumes represent the maximum extent to which any CoC is expected to migrate² not considered to be an acute threat to McArthur River water quality.
lead, zinc	<ul style="list-style-type: none"> key metals of the MRM deposit and associated mineralisation, present in high concentrations contained in acidic mine drainage more soluble and mobile at higher acidity potentially toxic at high concentrations in aquatic systems.
cadmium, arsenic	<ul style="list-style-type: none"> contained in mine drainage, generally at low concentrations, may be mobile in neutral pH conditions potentially toxic at high concentrations in aquatic ecosystems.

² Sulfate is soluble and moves freely in water, and is generally not attenuated in the aquifers as metals are, therefore its distribution represents the maximum extent a CoC may migrate.

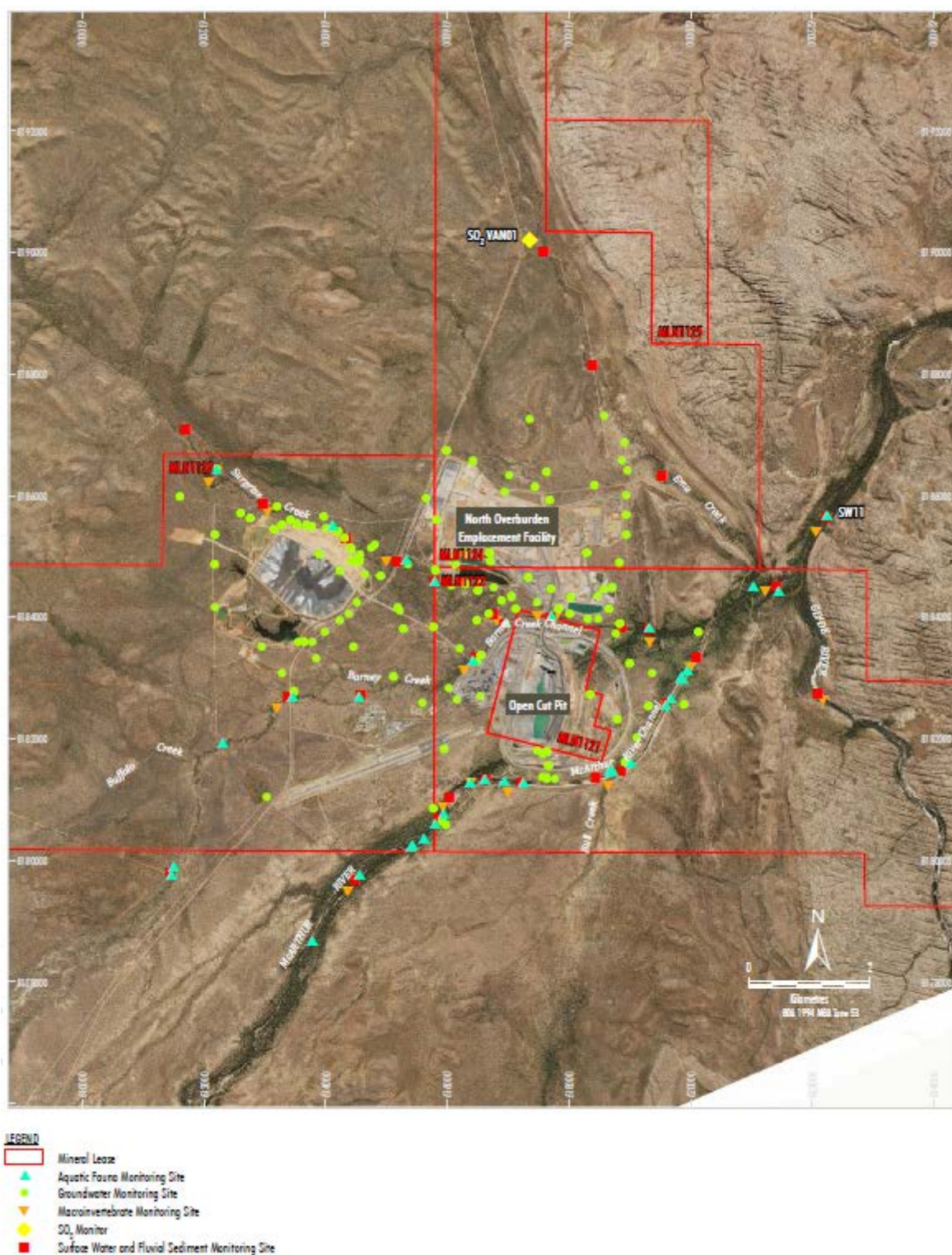


Figure 2: Monitoring sites at MRM (from EIS additional information - Environmental Performance Summary 2018)

Existing northern overburden emplacement facility domain

The NOEF is the principal and largest waste rock dump at the mine. Overburden has been placed at the current site since 2008 and currently contains about 25 Mt of waste rock. The NOEF domain includes the Central West (CW) stage, which is currently under construction, and three perimeter runoff dams (PRODs), designed to capture and collect poor quality runoff waters from the toe of the NOEF.

The foundations of the existing NOEF do not have a basal compacted clay layer, but do have in situ clay of varying thickness (1.5 m in west to 12 m in east) (IM, 2017). Above this, the NOEF base comprises undifferentiated NAF (mixture of LS-NAF/MS-NAF – see Table 1) built up to elevate PAF material above the 1:100 year flood level and forming a wedge, sloping towards the perimeter. A 0.6 m thick compacted clay layer was built on top of the base in the area of planned PAF encapsulation (in the western part of the NOEF), with runoff from the clay layer captured by PRODs.

A ‘reconstruction’ of the waste rock composition of the NOEF according to the updated characterisation (Table 1) predicted that 13% of the total mass of the NOEF is PAF(HC) and five percent is PAF(RE) (draft EIS Chapter 3). The PAF cell accounts for 42% of the total NOEF volume, but is predominantly composed of MS-NAF. Results also indicate that the NOEF base is probably dominated by MS-NAF.

Methods previously used to construct the NOEF facilitated rapid oxidation of PAF(HC) and PAF(RE) materials such that spontaneous combustion effects including sulfur dioxide plumes and ‘smokers’ have been observed from the facility (see Section 5.1.4.1). Since 2014 the Proponent has undertaken remedial works on the NOEF. While this has led to reduced dump temperatures and the elimination of sulfur dioxide emissions and ‘smokers’, internal temperatures are still elevated showing that PAF oxidation is still occurring (IM, 2017).

Monitoring of sulfate concentrations in groundwater over the life of the NOEF has shown a rapid increase ranging from less than 850 mg/L in some bores to around 2500 to 4500 mg/L since around 2008 (Ecological Australia, 2017). Sulfate concentrations measured at bore GW065D south of SPROD at the end of 2017 reached 4370 mg/L compared with levels of around 250 mg/L in the years leading up to 2010 for that site (Figure 3). The only bores with significant rising trends are bores south of the SPROD measuring salinity. The pH has declined slightly at monitoring bores south and west of SPROD and south of SEPROD (Ecological Australia, 2017). Increased salinity trends may be due to seepage from these ponds and declines in pH may be due to acidic runoff from the low grade ore stockpile to SEPROD following dust mitigation in 2016 and subsequent acid remediation trials (Ecological Australia, 2017; IM, 2017).



Figure 3: Sulfate trends (mg/L) for representative bores around the NOEF (SPROD and SPSP) (Data source: Ecological Australia, 2017)

Poor quality seepage from the NOEF domain is reporting to groundwater and surface waters nearby (IM, 2017) and in particular the Barney Creek diversion. Any water not captured in the WMS flows into the McArthur River during storm events. Monitoring over the period 2008 to 2014 indicated higher concentrations of sulfates, zinc and lead adjacent to and downstream of the NOEF compared to upstream of the NOEF in Barney and Surprise Creeks (Figure 4).

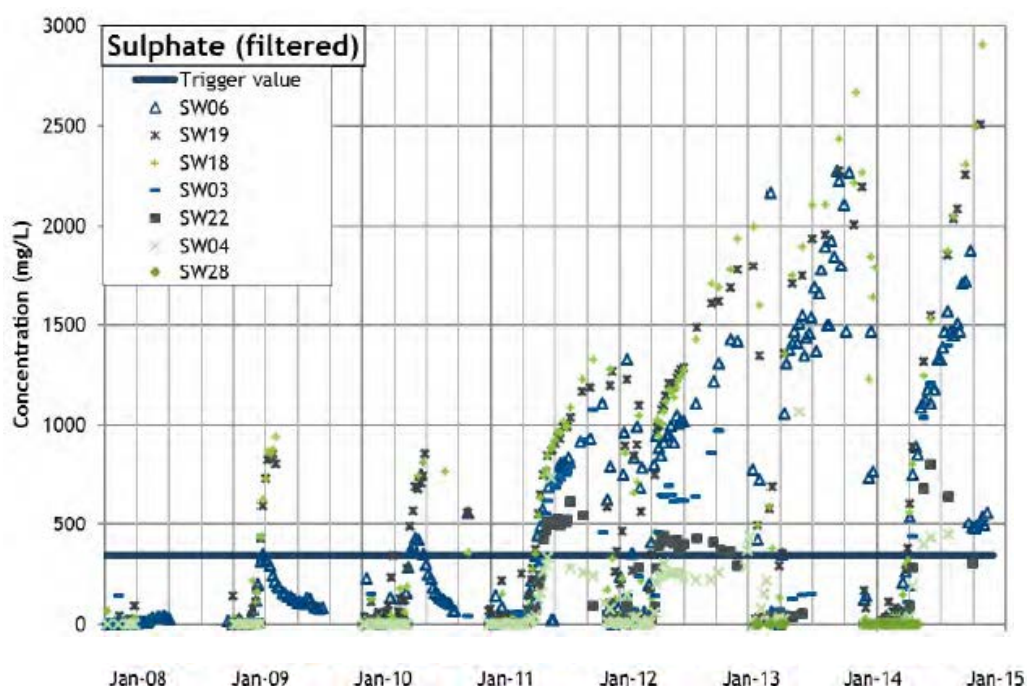


Figure 4: Sulfate concentrations at all monitoring sites along Barney Creek (Data source: draft EIS Appendix U).

Chapter 8 of the draft EIS predicts increased seepage and drainage from the NOEF in the coming decades (Figure 5).

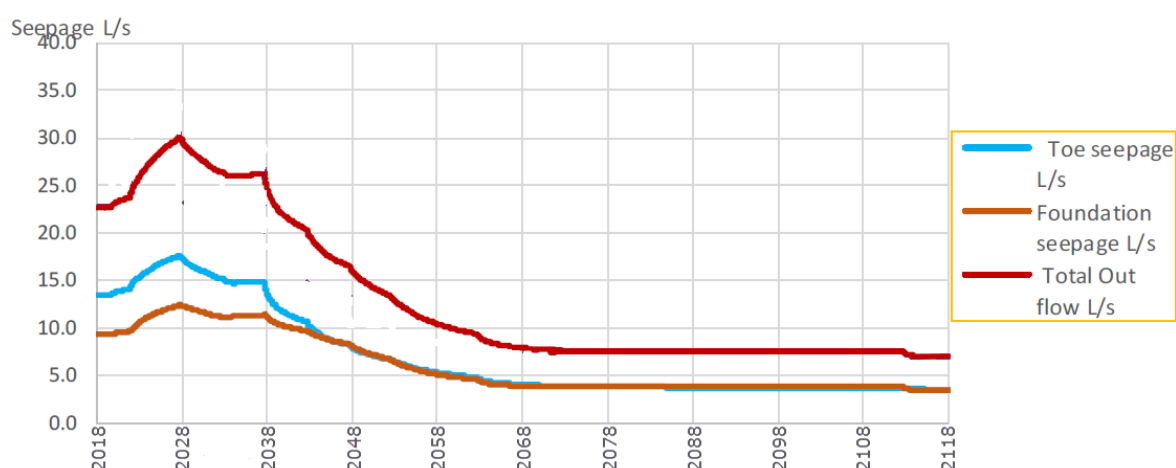


Figure 5: Prediction of NOEF long-term seepage (L/s) (Data source: draft EIS Chapter 8).

In conclusion, oxidation of PAF materials and leakage from run-off dams in the NOEF domain continues to occur, albeit at a reduced level than previously. Poor quality seepage from the NOEF and underlying groundwater reports to Barney Creek, resulting in locally impacted water quality. There is a significant future risk to water quality and aquatic life in the McArthur River unless further and more intensive management measures are implemented.

Existing tailings storage facility domain

The existing TSF is located 3 m above the 1 in 100 year flood level. At present, the TSF comprises three cells: cell 1 is full and inactive, cell 2 is active, and cell 3 is used as a water management dam.

In general, tailings fit the classification of PAF(HC) (see Table 1) but with significant lag times expected for acid generation (possibly years) due to their intrinsic buffering capacity (acid neutralising capacity of over 100 kg H₂SO₄/t due to the presence of dolomite and calcite). Leachate from the tailings therefore has a neutral pH at present, which means a lower metal content in seepage than would occur with acidic leachate.

The tailings are characterised by significant sulfide content, typically averaging 13%, mainly in the form of pyrite. The tailings also have elevated concentrations of metals including arsenic, cadmium, lead, zinc and copper. A proportion of these metals leach to groundwater even under neutral pH conditions. The reactivity of the tailings depends on moisture content with saturated tailings (>80% moisture) having a lower reactivity than dry tailings. The tailings can retain moisture for relatively extended periods as they are fine grained with a reported clay content of around 20%.

Seepage has been occurring from the TSF for many years (EPA, 2006) and is an ongoing issue through the cell 2 embankment (IM, 2017). Poor quality leachate from the TSF reports to groundwater and surface water (IM, 2017). Since 1995, when mining began, sulfate concentrations in groundwater around the TSF have increased (URS, 2005) and monitoring results from 2001 to 2017 show that groundwater in the vicinity of the TSF has elevated sulfate concentrations (exceeding 6000 mg/L in some bores close to the TSF) compared with upstream sites. The zinc levels in bores are mostly low (0.05 – 0.1 mg/L) but a high concentration of 3.66 mg/L was recorded to the north of cell 1 adjacent to Surprise Creek. There has been a slight increasing trend in salinity in bores immediately adjacent and within the TSF area (Ecological Australia, 2017).

Seepage from the TSF reports to waters in Surprise Creek and Little Barney Creek, which both flow into the Barney Creek diversion and then the McArthur River. Monitoring over the period 2008 to 2014 in these creeks indicated higher concentrations of sulfate and zinc adjacent to and downstream of the TSF compared to upstream of the TSF (Figure 6).

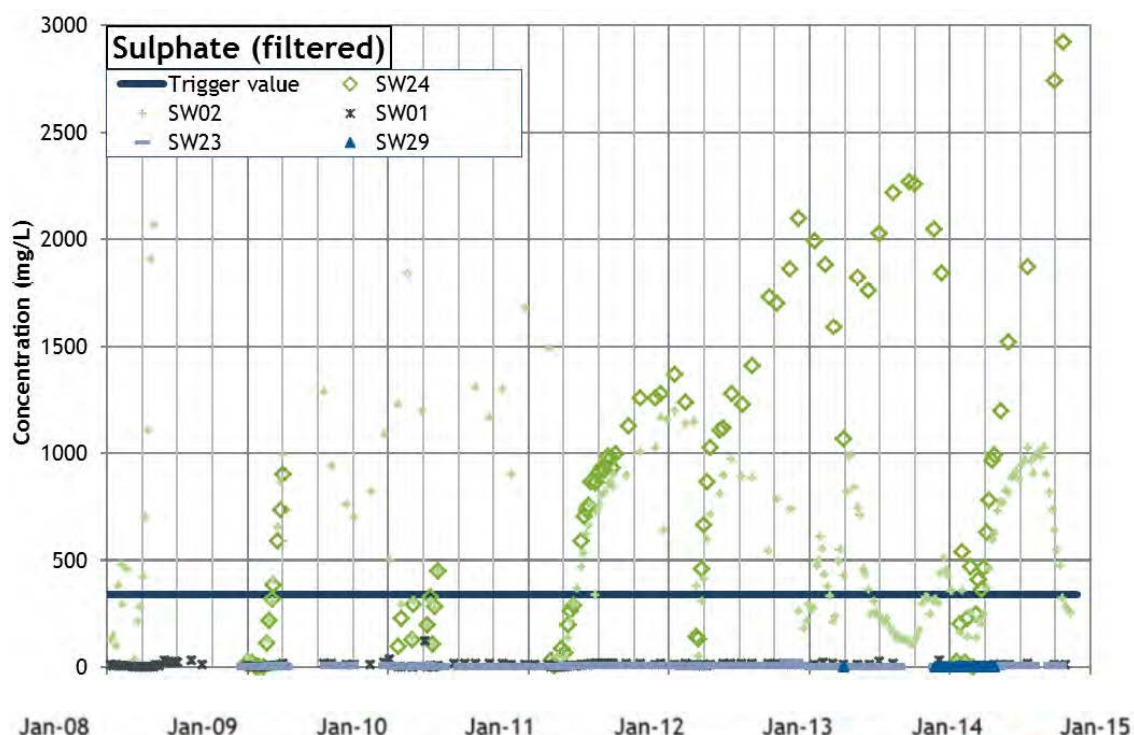


Figure 6: Sulfate concentrations at all monitoring locations along Surprise Creek (Data source: draft EIS Appendix U)

In conclusion, even though the TSF seepage is being actively managed through interception trenches and bores, seepage (via groundwater) is contributing to elevated sulfate concentrations in Surprise Creek compared to upstream of the TSF. There is a significant future risk to water quality and aquatic life in the McArthur River unless further and more intensive management measures are implemented.

Existing open pit domain

The open pit is a large void oriented north-south in the location of the previous natural channel of the McArthur River. The open pit domain includes several water storage dams and overburden emplacement facilities (OEFs). Beneath the open pit are redundant MRM underground mine workings that contain groundwater.

Groundwater and surface runoff which flows into the open pit and underground workings is pumped (dewatered) to the WMS to enable mining to continue in dry conditions. A levee wall extends around the entire open pit area to protect the mine and associated facilities from McArthur River flood flows.

Most seepage in the open pit domain (including southern and eastern OEFs) drains inwards to the pit due to drawdown from mine dewatering. Contaminants from the pit are removed through the WMS. Water extracted from the pit was previously stored in the eastern levee storage (ELS) dam but this was discontinued in 2015 due to the suspected seepage of poor-quality water towards the McArthur River diversion (Ecological Australia, 2017). A groundwater sulfate plume from the ELS continues to migrate towards the McArthur River but the influence on water quality in the river diversion is considered to be minor (IM, 2017).

Some seepage from the western OEF (now the foundation for workshops, offices and the ROM pad) in the pit domain drains north to the Barney Creek diversion or the old McArthur River channel. There is uncertainty about the composition of material in the western OEF, though it is presumed to include a PAF cell with mixed PAF(HC) and PAF(RE)) encapsulated in clay.

High sulfate concentrations have been recorded at monitoring bore GW128 located between the southern end of the TSF and pit. Whilst these may be from natural mineralisation in the area, it is also possible that the elevated concentrations could be from groundwater flow from the TSF or the pit domain (ERIAS Group, 2018). The pattern of sources and flow of sulfate in groundwater can be seen in a plot of contours of sulfate concentrations in bores over the whole MRM site (Figure 7).

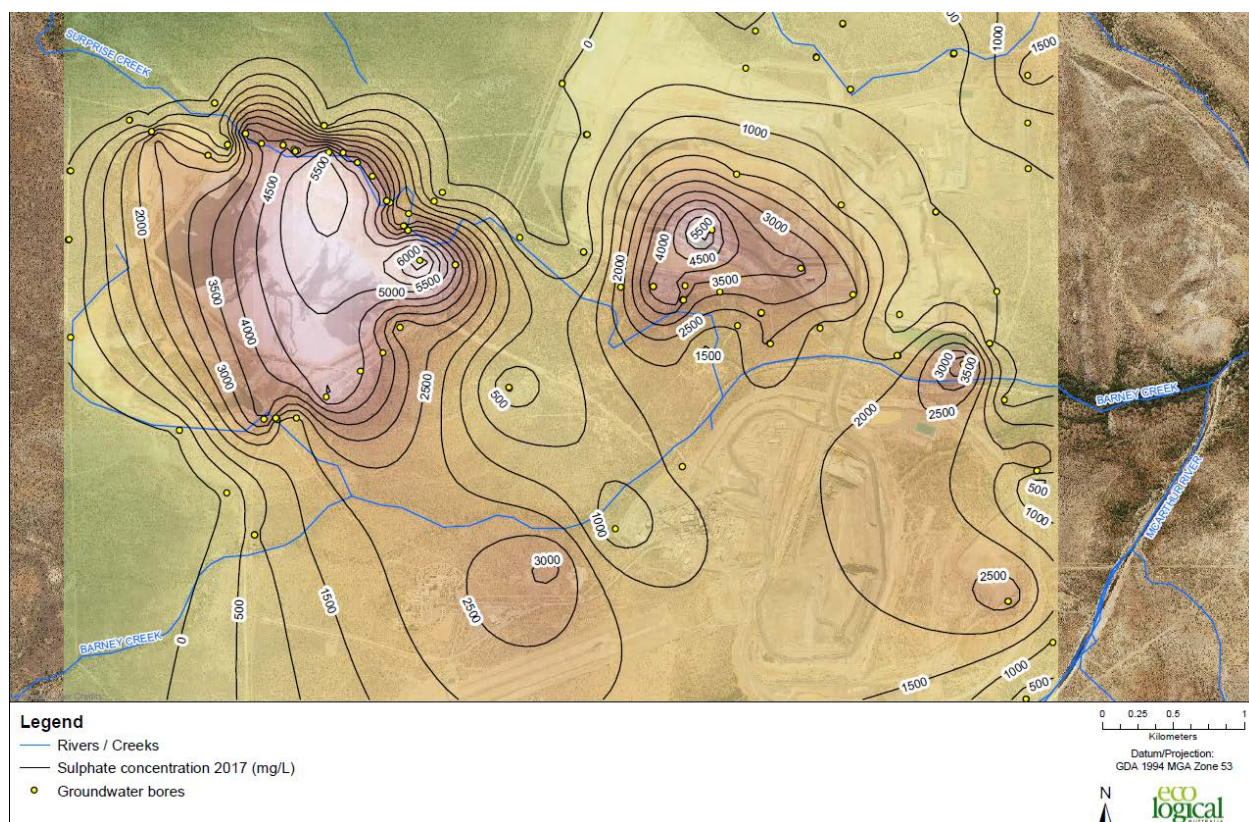


Figure 7: Sulfate concentration contours on MRM site (during 2017) (Data source: Ecological Australia, 2017)

While elevated sulfate concentrations are localised to the main sources at present, including the NOEF and TSF, it is evident that plumes of contaminated groundwater are flowing towards creeks on the site, the pit and ultimately the McArthur River. The NT EPA has therefore considered the cumulative impact of the sources on the site as a consequence of the change in rock characteristics, and not just the NOEF.

Dust has also been a concern on the site in this domain and the NOEF domain. Lead and zinc concentrations in mine-affected areas of Barney Creek are on average higher than control sites (Ecological Australia, 2017), and dust from haulage and other mining activities was considered a contributor (Figure 8). Dust mitigation measures were implemented in 2014 (IM, 2016) and since then lead concentrations in fluvial sediments in Barney Creek have reduced (Figure 9) (Ecological Australia, 2017).

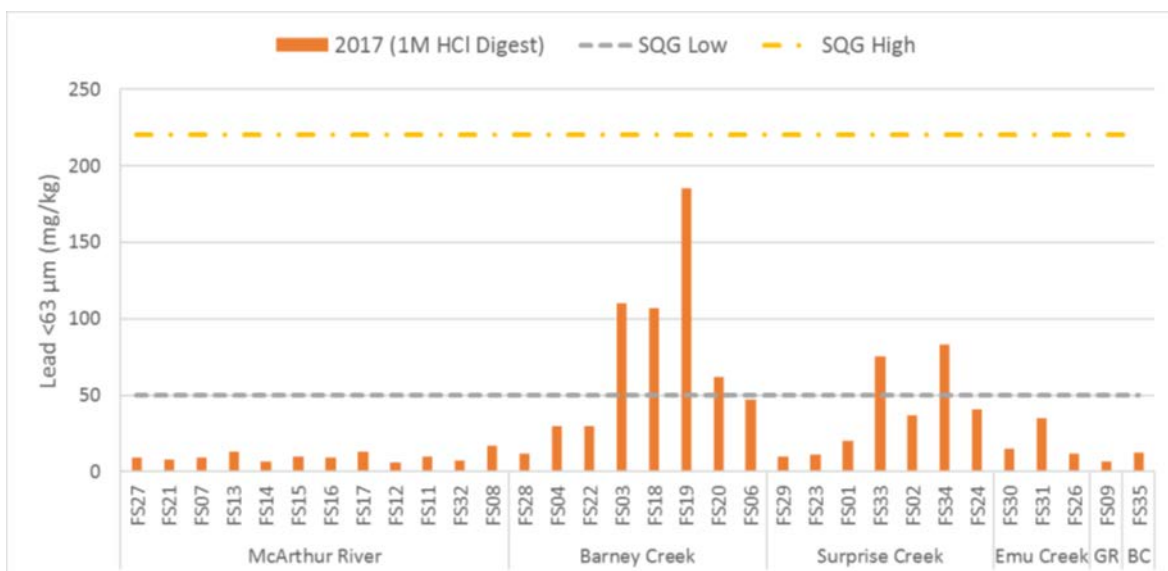


Figure 8: Bioavailable lead in fluvial sediments in 2016/17 compared against sediment quality guideline. Note GR = Glyde River; BC = Bull Creek (data source: MRM, 2017a)

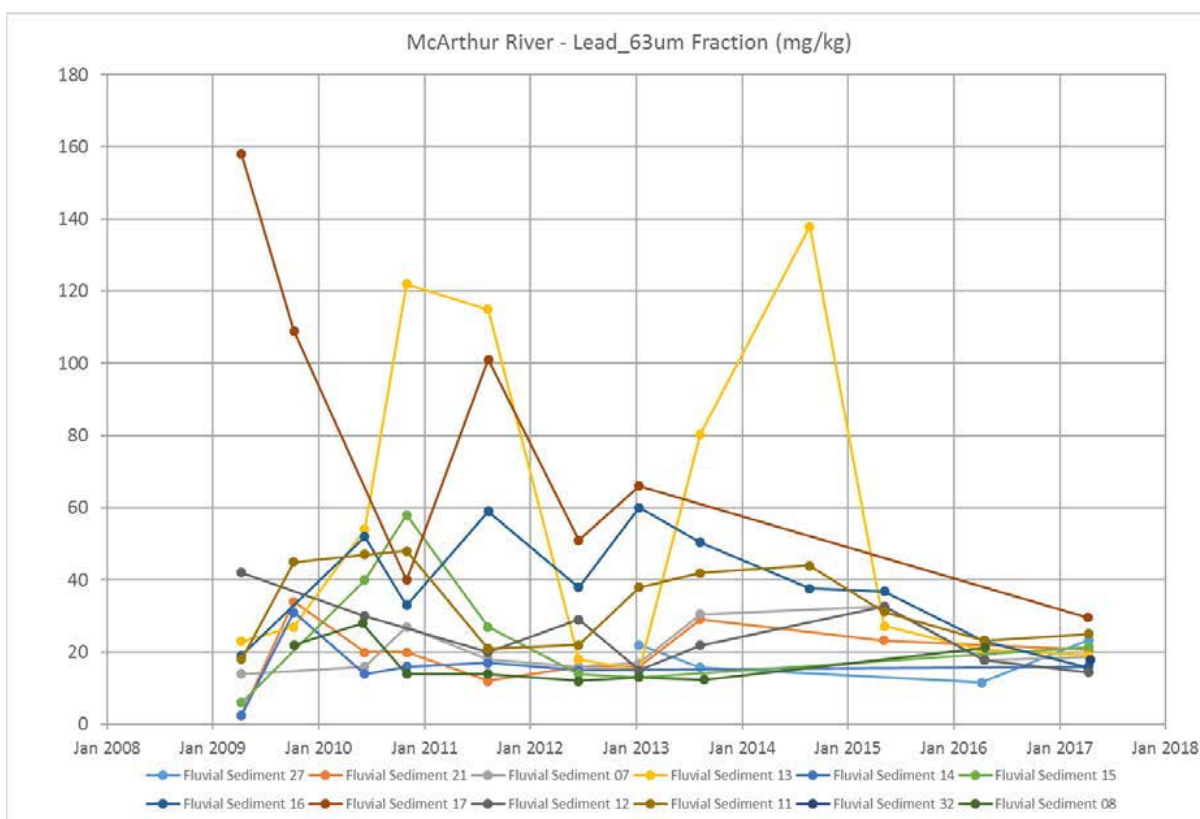


Figure 9: Long-term total lead in fluvial sediments of McArthur River (Data source: Ecological Australia, 2017)

In summary, the majority of seepage from this domain is collected in the pit, removed by dewatering and managed through the WMS. There may be some minor contribution of CoCs from this domain to groundwater flowing towards the Barney Creek diversion or the old McArthur River channel from the western OEF, and towards the McArthur River diversion from the ELS.

After mining ceases, pit dewatering will also cease and there is a significant risk that seepage that reports to the pit at present and is managed through the WMS, will flow to the McArthur River.

1.3.3.2 Condition of McArthur River receiving environment

The McArthur River flows past the MRM site, through the diversion channel constructed around the open pit by the Proponent in 2008. Within the MRM site, the old channel of the McArthur River receives inflow from the Barney Creek diversion (including waters from Surprise Creek). Downstream of the MRM site the river flows for about 60 km to the town of Borroloola (see Section 5.4.2) and then for a further 60 km through its long tidal estuary and into the Gulf of Carpentaria. The river has important values including aquatic and terrestrial ecosystems, recreational use (especially fishing), stock drinking water, and cultural/spiritual values (see Section 5.1.2).

The diversion channel effectively conveys all river flows from the natural river channel upstream (approximately half of the total McArthur River catchment) to the natural river channel downstream of MRM. Extensive revegetation works have been undertaken and have increased vegetation along the channel. Large woody debris has been installed and retained in the channel and a number of perennial pools have been established. Fish communities in the diversion channel are comparable to the natural river channel (IM, 2016).

Monitoring data from 2008 to 2014 show that, during times of low flow, sulfate concentrations in the McArthur River diversion and downstream of the three domains (SW16, SW17, SW12, SW11) were higher than at monitoring sites upstream (SW27, SW21, SW07, SW13, SW14, SW15) of MRM (Figure 10 and Figure 11). Zones of mineralisation exposed by excavation of the diversion banks are likely to be the main source of sulfate in the diversion (IM, 2017), and the ELS may be another source. It is likely that mine-derived contaminants also contribute to the elevated sulfate concentrations downstream of the diversion.

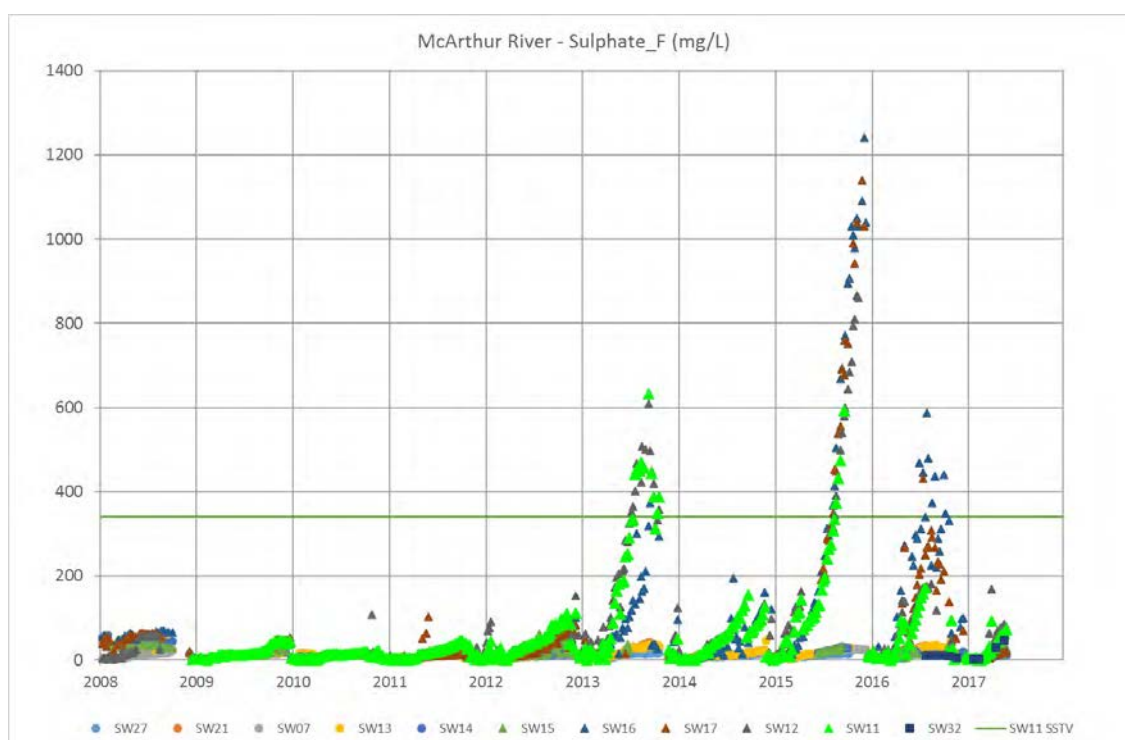


Figure 10: Long-term time series for sulfate in McArthur River sites (Data source: MRM, 2017b)

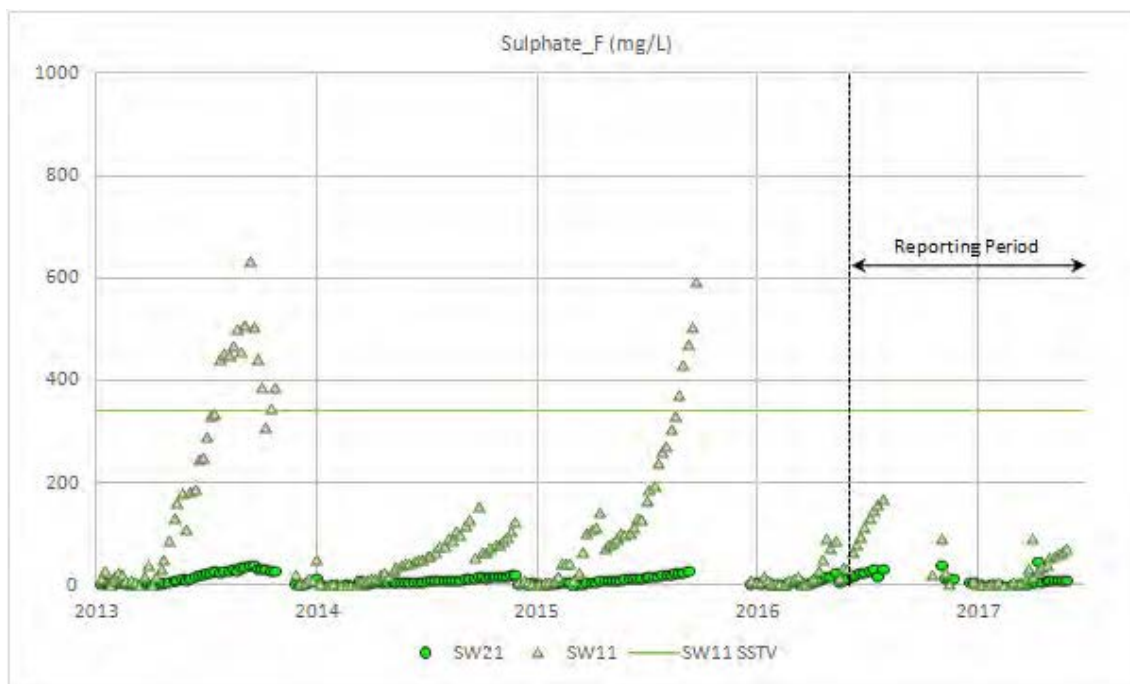


Figure 11: Long term time series for sulfate at SW11 (downstream) and SW21 (upstream) (Data source: MRM, 2017b)

The three MRM domains (NOEF, TSF and mine pit) cumulatively contribute contaminant loads to the McArthur River. Mine derived contaminants can enter the river either directly from drainage via groundwater or surface water, or in licensed discharges that occur during times of high flows in the river (for dilution of contaminants).

It should be noted that while exceedances of waste discharge licence trigger levels at the SW11 compliance point have been recorded from time to time for aluminium, salinity (as EC), sulfate and iron, the available data indicates that these exceedances may reflect natural influences (aluminium and iron) as well as mine inputs (salinity and sulfate) and have not resulted in impacts to the waterways beyond the mineral lease boundary. Further work by the Proponent will be required to establish the contaminant loading to the river from mine-derived sediments as these have not been measured in the past.

Monitoring results from 2008 to 2014 indicate that contaminant concentrations in the old McArthur River channel downstream from the mine pit and mine-site creeks are similar to those in Barney Creek (draft EIS Appendix U Appendix A) as all flows from the mine site channel through this site before meeting the McArthur River below the diversion channel confluence.

McArthur River receiving environment in discharge events

Downstream of the mine, water quality in the McArthur River is required to comply with the limits set in the waste discharge licence when MRM discharges stored waste water to the river (typically about 4 to 6 days per year, at times of high river flows). Monitoring of water quality at SW11 during discharge events has shown that water quality has generally complied with trigger values set in the licence (Table 3). Concentrations of the key metals of concern (zinc, lead, cadmium, arsenic) were below both the licensed trigger values and the ANZECC/ARMCANZ (2000) 95% level of protection guideline values (IM, 2017) at SW11 over the period 2008 to 2018. Historically sulfate concentrations occasionally exceeded the trigger values, but in recent years the records have shown an improvement in performance, with no exceedances in the most recent April 2017 to April 2018 monitoring period.

Table 3: Comparison of MRM Monitoring Data for SW11 with WDL Requirements (IM, 2017)

WDL 174-07 and WDL 174-08 ¹			MRM Monitoring Data (SW11) ²
Parameter	Units	Site-specific Trigger Value (SSTV) for SW11	Oct 2015 – Sep 2016 ³ (Minimum – Maximum)
pH (in situ)	pH units	6.0 – 8.5	6.4 – 8.5
EC (in situ)	µS/cm	1,000	25 – 1,150
DO (in situ)	% saturation	85 – 120	78 – 147
Al (filtered 0.45 µm ⁴)	µg/L	55	2.4 – 238
As (filtered 0.45 µm)	µg/L	24	0.2 – 1.6
Cd (filtered 0.45 µm)	µg/L	1.73	<0.02 – 0.04
Cu (filtered 0.45 µm)	µg/L	10.97	0.52 – 4.26
Fe (filtered 0.45 µm)	µg/L	300	14 – 382
Pb (filtered 0.45 µm)	µg/L	16.6	<0.01 – 0.48
Mn (filtered 0.45 µm)	µg/L	1,900	0.42 – 611
Hg (filtered 0.45 µm)	µg/L	0.6	<0.02 – 0.02
Ni (filtered 0.45 µm)	µg/L	11	0.04 – 1.18
Zn (filtered 0.45 µm)	µg/L	62.68	0.3 – 5.2
TPH fraction C6-C9 (filtered 0.45 µm)	µg/L	N/A	N/A
Benzene (filtered 0.45 µm)	µg/L	950	All values <2
TPH fraction C10-C14 (filtered 0.45 µm)	µg/L	600	<50 – 280
C15-C28 (filtered 0.45 µm)			
C29-C36 (filtered 0.45 µm)			
SO ₄ (filtered 0.45 µm)	mg/L	341	0.9 – 171
NO ₃ (filtered 0.45 µm)	µg/L	700	<22 – 1,439

1. WDL174-07 was applicable until 17 March 2016, after which WDL 174-08 was applicable; the SSTVs remained the same.

2. Ranges of values were extracted from spreadsheets provided by MRM.

3. Values in **bold** lie outside the relevant SSTV.

4. The licence actually refers to 'Total and filtered (0.45 µg/l)' for metals and metalloids.

In summary, the McArthur River receives contaminants derived from operations at MRM through the old McArthur River channel, which has poor water quality. Downstream of the MRM mining leases, water quality has generally complied with trigger values set in the waste discharge licence for protection of downstream values and no impacts to aquatic habitat have been detected.

Biological conditions in the McArthur River receiving environment

The available biological data indicates that aquatic habitats in the McArthur River are in good condition but are compromised in creeks adjacent to the NOEF and TSF to some extent, as would be expected for an operating mine.

Overall, monitoring results indicate that the McArthur River and its tributaries continue to support a diverse and regionally representative freshwater fish community. Overall diversity and abundance of fish and crustaceans is statistically similar between sites directly below and above the mineral lease in most years, indicating MRM operations have had no measurable impact on aquatic fauna communities. There has been no observable decline in species diversity in waters upstream and downstream of the mineral lease, outside of what would be considered natural variation or as a result of variable seasonal flows or changes in river bed morphology.

Within the McArthur River diversion channel, where complex habitat is provided, fish communities and freshwater shrimp abundances are similar to natural areas outside the diversion channel. There has been no observable decline in species diversity in waters upstream and downstream of the mineral lease (Figure 12). Results show marine vagrants and migrants, such as barramundi and largemouth sawfish, are able to traverse the McArthur River diversion channel.

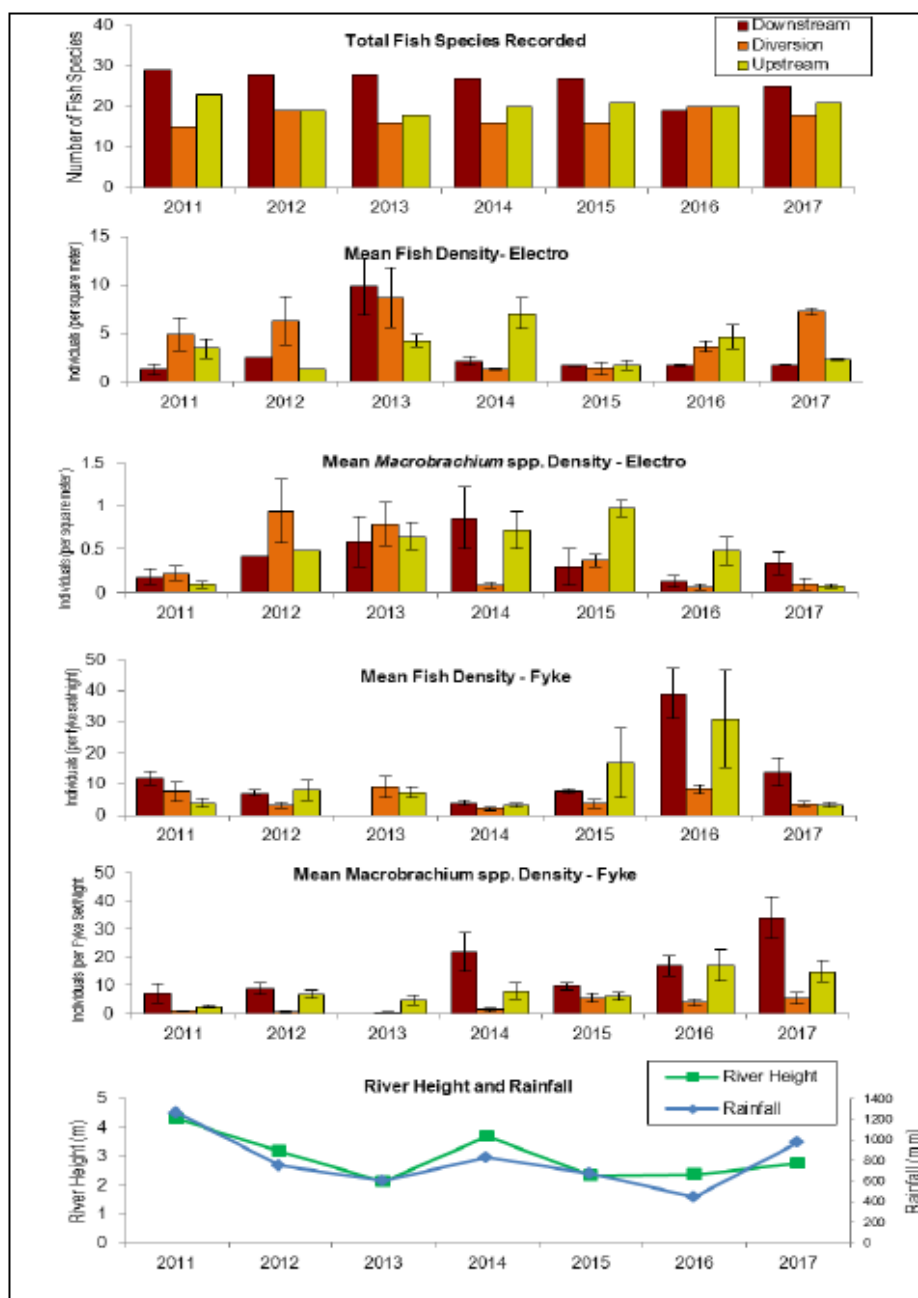


Figure 12: Total number of fish species, mean (\pm SE) number of fish and *Macrobrachium* spp. captured per metre (electro-fishing and fyke netting) per 24-hrs at downstream, in and upstream of diversion during the early Dry season (Data source: EIS additional information - Environmental Performance Summary 2018).

Monitoring of fish species in the McArthur River since 2006 has demonstrated that fish do not contain elevated levels of metals and are safe for human consumption in amounts recommended by the Department of Health (see section 5.5.4). Although there is evidence of contamination in the vicinity of the mine site, the majority of biota collected from locations within the mineral lease which are inaccessible to the public, had concentrations of lead and other metals well below their respective maximum

permissible concentrations. Data to date indicates there is an extremely low risk to human health from consuming the monitored fish species caught in the McArthur River catchment downstream or upstream of the mineral lease based on the reviewed monitoring data.

There have been no significant declines or changes in freshwater macroinvertebrate populations as a result of MRM mining and processing operations detected at downstream reference sites during monitoring conducted between 2008 and 2017. Statistical analyses indicate that riffle macroinvertebrate communities in the McArthur River diversion channel are similar to natural riffle communities as measured at major drainage line reference sites on all surveyed rivers and the McArthur River. As expected, monitoring of macroinvertebrate communities has shown altered assemblages in Barney Creek and Surprise Creek on the mine site compared with reference sites (MRM, 2017).

1.3.4 Existing governance and oversight

Activities on the mining lease are regulated under the MM Act and off-lease compliance monitoring is conducted through the WDL under the *Water Act*. The Proponent conducts monitoring in accordance with its MMP and WDL requirements and receives advice from its NOEF and tailings 'independent review boards' in regards to those domains, and an independent certifying engineer in respect of the Central West NOEF. Information derived from monitoring and advice is audited annually by the Independent Monitor, with its report on the mine's and the regulator's performance in the preceding year made public. The Independent Monitor assessment conditions are included in the Authorisation under the MM Act.

Further detail on the governance structure, its current failings and proposed improvements is included in Section 7.3 of this Report.

2 The Proposal

2.1 Proponent

The Project proponent, McArthur River Mining Pty. Ltd. (ABN 008 167 815), is the current operator of MRM and a wholly owned subsidiary of Glencore plc (Glencore). Glencore is an Anglo-Swiss multinational commodity trading and mining company with headquarters in Baar, Switzerland and has operated in Australia for 20 years, with projects distributed in all mainland states and the Northern Territory. MRM is Glencore's only project in the Northern Territory.

2.2 Proposal description

The Proposal comprises a number of components that would be altered from the previously approved Phase 3 Development Project. These proposed alterations are primarily in response to the need to revise methods for handling waste rock and redesign the waste rock disposal facilities, as outlined in section 1.1.1. Additionally, the Proposal includes updated options for closure which take account of the revised rock characteristics.

The Proposal will result in some changes to LOM footprint and extent, compared to the previously assessed Phase 3 proposal. The maximum disturbance footprint of the Proposal is approximately 1812 ha. The comparison of current (Phase 3) operations and the changes that will result from the Proposal are summarised in Table 4.

Table 4 Comparison of Phase 3 operations to OMP Proposal (Table 6-1 Supplement)

Component	Current operations (i.e. Phase 3 operations + MMP amendments)	Proposal
Ore remaining from 2018	90 million tonnes (Mt)	92 Mt
Mining Rate	Up to 5.5 million tonnes per annum (Mt/y) of ROM ore.	No change.
Mining life	Until 2036 (at 5.0 Mt/y).	Until 2037 (at 5.0 Mt/y) plus 10 years of tailings reprocessing (to 2047).
Mining method	Open cut mine using conventional drilling, blasting, loading and haulage methods.	No change.
Open cut dimensions	Length: 1750 metres (m) Width: 1500 m Depth: 420 m Overall footprint: 210 hectares (ha) (within the existing approved bunded area).	Length: 1950 m Width: 1550 m Depth: 420 m Overall footprint – 265 ha (within the existing approved bunded area)
Overburden	530 Mt Stored on surface in two existing OEFs (NOEF & WOEF) and two new permanent facilities (SOEF, EOEF). Total clearing of 485 ha for NOEF to 80 m height. Compacted clay layer (CCL)	595 Mt (this volume includes additional benign material specifically mined to supply closure materials). Stored on surface in two permanent OEFs (WOEF and NOEF), two temporary OEFs within the Mine Levee Wall (SOEF, EOEF) and in-pit placement. NOEF redesigned, including: <ul style="list-style-type: none"> • Cover and integrate existing NOEF into new expanded NOEF • change method of placement of waste • increase height to 140 m • total footprint 511 ha • Geosynthetic liner to replace CCL • NOEF basal CCL reduced to 250 mm • Upper NOEF batter slope at 1V:3H
Processing	Heavy Media Plant (HMP) treats some ore in a pre-concentration phase. Flotation process producing bulk concentrate and separate zinc and lead concentrates.	No change to HMP. No material change to processes or concentrates produced.

Component	Current operations (i.e. Phase 3 operations + MMP amendments)	Proposal
Power	Gas power station with a capacity total of 54 megawatts.	No change.
Product	Up to 800 kilotonnes per annum of total concentrates, comprised of bulk, lead and zinc concentrates.	No change.
Tailings	Tailings discharged to TSF Cells 2, 3 and 4.	Tailings deposition in consolidated Cells 1 and 2 only. Install interception trench.
	Cell 1 decommissioned and rehabilitated.	Cell 3 used for water management. No Cell 4.
	Cell 4 proposed as water management dam initially (not approved).	Tailings reprocessed and placed back into the open cut when mining complete. The TSF footprint will be rehabilitated.
Transport	Concentrate trucked 115 km to Bing Bong, transferred to barge, barged to offshore loading area onto bulk carriers (18 truck movements per day and 250 barge movements per year).	No change to methods. Reduced frequency of movements during the tailings reprocessing phase.
	Lead concentrate transport to Mount Isa or Darwin.	
Water management system	Borefields for water supply.	TSF Cell 3 dam divided into lined water management dam and Process Water Dam (PWD).
	Mine water collected and utilised in the process.	Increased WTP capacity to 15 ML/d total.
	Evaporation from on-site dams.	
	TSF Cell 3 dams and NOEF PRODs for water management.	
	Water treatment plant (WTP) with 6 megalitres per day (ML/d) capacity (not commissioned).	
Workforce	Approximately 440 permanent staff and contractors (head count).	Operational phase workforce head count average at approximately 840 permanent staff and contractors with fluctuations between 550 and 1020 depending on project stage and activities. Tailings reprocessing phase average of approximately 180 staff and contractors.
	Construction phase workforce peak at approximately 930.	
	Operational phase workforce peak at approximately 735 permanent staff and contractors.	

The main differences between the Proposal and the approved Phase 3 project are:

- the redesign of the NOEF with an increased height from 80 m to 140 m
- TSF Cell 4 is not required

- the complete removal of the TSF as part of site rehabilitation with reprocessing of tailings to recover metals and disposal of residual tailings in the base of the pit at the cessation of mining
- reduction of the Phase 3 EOEF and SOEF to smaller, temporary structures inside the mine levee wall only (and for the disposal of this material in the base of the pit at the cessation of mining)
- the locations of benign material borrow pits and stockpiles for the TSF have been defined in the Proposal, including the Woyzbun Quarry within the mine levee wall.

The EIS introduces and discusses options for the closure of the pit after mining is completed, including rapid filling to an isolated pit lake, a pit connected to the downstream reach of the McArthur River at times of high river flows (back flow pit option) or a pit connected to both upstream and downstream reaches of the McArthur River at times of high river flows (flow through pit option).

Chapter 3 of the draft EIS presents a detailed description of the Proposal and Section 6 of the Supplement presents a revised, simplified description. A number of elements of the Proposal changed during the course of the environmental assessment. These are identified where relevant, and discussed further in Section 5 of this Report.

3 Consultation

3.1 Public consultation

The draft Terms of Reference were made available for public comment for a period of 14 calendar days, from 29 August to 12 September 2014. Responses were received from NT Government agencies and three non-government respondents. The Terms of Reference were finalised, taking into account comments received, and issued to the Proponent on 22 September 2014.

The draft EIS for the Proposal underwent a six week public exhibition period between 22 March 2017 and 3 May 2017. The NT EPA received a number of requests to extend the period for public comment. With agreement of the Proponent, the timeframe for comment for those who requested an extension was extended for an additional two weeks. Submissions on the draft EIS were received from NT Government advisory bodies and the public. The public submissions were from three non-government organisations (NGOs): the Environment Centre of the Northern Territory (ECNT), the Northern Land Council (NLC) and the Environmental Defenders' Office NT (EDO). The EDO's submission was made on behalf of nine individuals from the region of the Proposal, most of whom were identified by the Proponent as associated with the Garawa language group (Supplement Appendix Q Appendix A).

All submissions were forwarded to the Proponent who responded to each in the Supplement to the draft EIS. The NT EPA has also considered each submission in writing this Report. The three public submissions are presented in Appendix 2 to this report. The main issues raised in those submissions are summarised below.

- Opinion that the draft EIS lacked sufficient accurate detail on the history of MRM's development that is relevant to assessing the Proposal.
- Concern that contaminants from the Proposal (NOEF, TSF or pit) would indefinitely enter the environment due to ineffective designs or failure of the designs. Contaminants could include products of spontaneous combustion or oxidation of waste rock, including bioavailable metals. There was concern that these could impact on biodiversity and human health into the very long term

future, particularly if contaminants accumulated and magnified in the food chain in the McArthur River.

- Support for the tailings to be reprocessed and returned to the open pit, combined with concern that this part of the Proposal may be economically unviable and so may not occur.
- Opinion that all reactive materials should be returned to the open pit, including those already in the existing NOEF, and that full consideration should be given to completely filling the open pit with waste materials prior to closure.
- Concern regarding potential contamination in and from the proposed open pit lake and flowthrough of the McArthur River, and that a flow-through pit lake option is not supported by local stakeholders.
- Concern that all closure options will require ongoing maintenance for a very long time and subsequently that potential impacts on the environment including people are highly uncertain.
- Concern that the relevant Aboriginal people (with authority, knowledge and/or interests in lands or waters that may be impacted) have not been effectively identified and consulted by the Proponent.
- Opinion that the Proponent and the NT EPA have failed to actively engage potentially-affected Aboriginal people in the consultation process on the Proposal, and that the Proponent's consultation methods do not meet the standards required under Australia's international obligations.
- Concern regarding the potential cultural impact of raising the height of the NOEF, and the legitimacy of the Proponent's agreement with traditional owners of the MRM site regarding the height increase.
- Concern regarding the potential impacts on the long term interests of Aboriginal people in the region, including future native title holders at the MRM site (after mining ceases). These interests include maintaining Aboriginal connections to lands and capacity to safely use waters and other resources for customary, recreational and commercial purposes.
- Opinion that the Proponent's analysis of socio-economic impacts of the Proposal is inadequate.
- Opinion that the economic benefits of the Proposal may be overstated and concern that the Proponent has not addressed how their economic benefits can contribute to a smooth transition to a post-mining economy.
- Opinion that the Proposal should not go ahead (i.e. mining should cease), or at least that ceasing operations should be given full consideration by the Proponent as an alternative to the Proposal.
- Lack of confidence that the Proponent and the NT Government regulators would employ/ensure best practice environmental management of the Proposal, including closure, and opinion that the bond would be inadequate to address environmental impacts if needed.
- Opinion that the NT assessment process (staggered piecemeal assessment) does not enable a full assessment of a proposal in the context of potential environmental impacts.

3.2 Proponent consultation

The Proponent reported on its consultation with 566 individuals representing the local community and other stakeholders regarding the Proposal (Supplement Appendix Q). Consultation was held between 14 May 2015 and 28 February 2018, and had a significant focus on custodians for Damangani and MRM4 (see Section 5.4.4.1) (Supplement p. 7-18). Feedback from consultation resulted in changes to the Proposal and continuing MRM operations including some adjustments to the design of the Proposal; improved community communications (e.g. Community Reference Group meetings were opened to the public); implementation of, or commitment to, more robust monitoring programs; and dedicated training and recruitment from the local area (draft EIS Appendix Y section 7; Supplement Appendix Q section 6).

Though the Proponent has reported a close relationship with the local community, underpinned by open communication and transparency (Supplement Appendix Q section 7), responses to the draft EIS indicate that not all stakeholders were satisfied with the consultation conducted by the Proponent. The EDO considered that the consultation process had been extended only superficially to local stakeholders other than the traditional owners of the MRM site. The NLC considered that the Proponent had not effectively consulted with relevant stakeholders and was critical of the process by which the custodians or traditional owners were identified by the Proponent.

3.3 NT EPA consultation

To inform its examination of the EIS, the NT EPA consulted with the following government advisory bodies and agencies:

- Department of Environment and Natural Resources
- Department of Infrastructure, Planning and Logistics
- Department of Transport
- Department of Primary Industry and Resources
- Department of Health, including the Chief Health Officer
- Power and Water Corporation
- Aboriginal Areas Protection Authority
- Department of Tourism and Culture
- NT Police, Fire and Emergency Services
- Department of Trade, Business and Innovation
- Department of the Attorney-General and Justice
- Department of the Chief Minister
- Department of the Environment and Energy (Australian Government).

The NT EPA engaged the ERIAS Group to provide an independent expert review of the draft EIS and Supplement.

In the period following the exhibition of the draft EIS, the NT EPA held meetings with a range of stakeholders to increase the NT EPA's understanding of the broad range of views and issues associated with the Proposal. The NT EPA attended the following meetings:

- site inspection of MRM in June 2017 (and May 2018 for members who missed the 2017 inspection)
- meetings with each of the three non-government respondents in August 2017

- meetings with representatives of four NT Government agencies (including DPIR, Aboriginal Areas Protection Authority (AAPA), Department of Tourism and Culture - Heritage Branch, and the Department of Health (DoH) in August 2017, October 2017, January 2018 and June 2018
- meetings with representatives of MRM in October 2017 and April 2018
- meetings with a representative of ERIAS Group in December 2017 and April 2018.

4 Key environmental factors

Having regard to the Notice of Intent, the Draft EIS and Supplement, additional information, and comments from the public and advisory bodies during the EIS review, the NT EPA identified the following key environmental factors that may be impacted by the Proposal:

- Inland water environmental quality
- Hydrological processes
- Aquatic ecosystems
- Social, economic and cultural surroundings
- Human health.

The NT EPA has considered the importance of other environmental factors during the course of its assessment. Those factors that were not identified as key environmental factors or that were addressed through consideration of the above factors are summarised at Appendix 3 of this Report.

The key environmental factors are discussed in Sections 5.1 to 5.5 of this Report. The description of each factor shows why it is relevant and how it would be affected by the Proposal. The assessment of each environmental factor concludes with a judgement by the NT EPA about whether or not the Proposal can meet the NT EPA's environmental objective for each factor with implementation of recommended management measures where required.

5 Assessment of environmental factors

This section evaluates the Proposal and presents the NT EPA's view on the environmental acceptability of the Proposal. The environmental acceptability of the Proposal is based on an analysis of:

- the Proposal (particularly the components or activities that are likely to have a significant impact on the environment),
- the existing environment (particularly environmental values and sensitivities),
- the potential environmental impacts and risks of the Proposal and the assessment of the significance of those impacts and risks,
- the proposed avoidance or minimisation / mitigation measures to reduce potential impacts and risks to acceptable levels and to meet the NT EPA objectives,

and the consideration of the principles of Ecologically Sustainable Development (ESD).

Conclusions drawn and recommendations made in this Report have taken into account the information obtained from consultation on the EIS with advisory bodies and the NT EPA's appointed independent expert, the NT EPA's examination of the EIS (comprising of the Draft EIS and the Supplement, and the additional information supplied by the Proponent at the request of the NT EPA), and responses from the Proponent to

comments received during the environmental impact assessment (EIA) exhibition period. Recommendations are made in this Report to add, emphasise or clarify any commitments made by the Proponent, where the proposed avoidance or minimisation/mitigation measures are considered insufficient to achieve the NT EPA's objectives or where a safeguard or intervention is deemed particularly important. The NT EPA has summarised its consideration of the principles of ESD in Appendix 4.

In this Report, the recommendations (in bold) are preceded by text that identifies issues and undertakings associated with the Proposal. For this reason, the recommendations should not be considered or read in isolation.

The NT EPA acknowledges that detailed design and operational plans for the Proposal have not been finalised. Minor and insubstantial changes are expected in the design, specifications and implementation of the Proposal following the conclusion of the EIA process. It will be necessary for approval mechanisms to accommodate subsequent changes to the environmental safeguards described in the EIS and recommendations in this Report.

If the Proponent is able to demonstrate that changes are unlikely to increase potential impacts on the environment, then a satisfactory level of environmental protection can be achieved by modifying the conditions through the authorised Adaptive Management Plan (Section 7.4 of this Report). Otherwise, further environmental assessment may be required.

Recommendation 1

The Proponent shall ensure that the McArthur River Mine Overburden Management Project is implemented in accordance with all environmental commitments and safeguards:

- i. **identified in the final Environmental Impact Statement for the McArthur River Mine Overburden Management Project (draft Environmental Impact Statement, Supplement to the draft Environmental Impact Statement and additional information)**
- ii. **recommended in this Assessment Report 86.**

The Northern Territory Environment Protection Authority considers that all safeguards and mitigation measures outlined in the Environmental Impact Statement are binding commitments made by the Proponent.

Where there is an inconsistency between the commitments made by the Proponent and these recommendations, the recommendations will take precedence.

Recommendation 2

The Proponent shall provide written notice to the Northern Territory Environment Protection Authority and the responsible Minister if it alters or proposes to alter the McArthur River Mine Overburden Management Project and/or commitments, safeguards or mitigation measures in the Environmental Impact Statement in such a manner that the environmental significance of the action may have changed, in accordance with clause 14A of the Environmental Assessment Administrative Procedures.

The remainder of this section identifies and assesses the key environmental factors and potential impacts and risks to values underlying those factors. The assessment is based on likely significance, the Proponent's investigations and studies, and/or the Proponent's

commitments to identify, avoid, mitigate, monitor and manage the potentially significant impacts and risks.

For each key environmental factor discussed in this Report, the NT EPA assessed whether or not the Proposal is likely to meet the NT EPA's defined environmental objective. The NT EPA also had regard to the principles of ESD articulated in the Intergovernmental Agreement on the Environment (1992):

- the precautionary principle
- the principle of intergenerational equity
- conservation of biological diversity and ecological integrity
- improved valuation, pricing and incentive mechanisms such as the "polluter pays" principle.

In its consideration of the objectives for the key environmental factors and the principles of ESD, the NT EPA formed a view that a central, overarching environmental outcome needed to be achieved. The McArthur River and the values it supports is the critical element of the receiving environment for the Proposal that links all the key environmental factors and which must be protected from mine-related degradation. The NT EPA therefore considers that to meet its environmental objectives, and the principles of ESD, the McArthur River must be maintained in a healthy condition at all times.

The NT EPA acknowledges there is a lack of full scientific certainty about the loads of contaminants that may be safely and harmlessly assimilated by the McArthur River receiving environment. It appears from the Proponent's monitoring of multiple environmental parameters that significant impacts are not currently observed in the McArthur River (Section 1.3.3.2). However, the NT EPA has taken a precautionary approach by recommending that annual contaminant loads discharged to the McArthur River from the mine site must not exceed current loads unless multiple lines of evidence are presented to support a contrary view.

Recommendation 3

The Proponent shall ensure that the commitments and safeguards listed in the EIS for the McArthur River Mine Overburden Management Project and recommended in this Assessment Report 86 are implemented in a manner and to the extent that ensures the health of the McArthur River is protected along its whole length at all times from mine related impacts. This is the overarching environmental outcome that is required to be achieved in respect of the Proposal and all future stages of the mine.

To ensure the protection of the McArthur River from mine related impacts, the Proponent shall ensure that the annual loads of lead and zinc discharged to the McArthur River in future years (July to June) do not exceed the loads discharged in 2017-2018, taking into account seasonal variations in rainfall, and subject to future annual load calculations.

The Proponent shall implement a monitoring program, developed in accordance with Recommendation 13, within six months of authorisation of the Proposal, to the satisfaction of the relevant regulator. The monitoring program shall quantify the annual loads of lead and zinc entering the main channel of the McArthur River and be used to assess whether or not the load limits specified herein have been met. A load summation shall be provided to the Independent Monitor for auditing at three yearly intervals.

The Proponent shall implement an Adaptive Management Plan, to be developed in accordance with Recommendation 28, to allow for management measures and

interventions to be adapted if necessary to achieve this overarching environmental outcome.

5.1 Inland water environmental quality

5.1.1 Environmental objective

Maintain the quality of groundwater and surface water so that environmental values including ecological health, land uses, and the welfare and amenity of people are protected.

5.1.2 Environmental values

The McArthur River, with a catchment of about 18 000 km², is the major surface water feature in the region flowing 330 km from its headwaters in the Barkly Ranges in a north-easterly direction to the Gulf of Carpentaria. The MRM site is located in the middle reaches of the McArthur River approximately 120 km upstream of the river mouth. The tidal limit of the river is reached a few kilometres upstream of Borroloola and the river forms an extensive estuary complex further downstream of Borroloola. In most years, the McArthur River flows from December to April, with low to zero flows in the months of May to November. During the dry months, the river forms intermittent pools.

Tributaries associated with the mine site include Surprise Creek with a catchment area of approximately 100 km², Barney Creek with a catchment area of approximately 700 km²; and Emu Creek with a catchment area of approximately 65 km² (draft EIS Appendix U). The Barney Creek sub-catchment area, including Surprise Creek, represents approximately 4.5% of the total McArthur River catchment area and ~7% of the catchment upstream of the mine. These creeks are mostly ephemeral with high streamflow in the Wet season and little to no streamflow during the Dry season (draft EIS Appendix U).

The environmental values ascribed by the Proponent to the McArthur River are based on the National Water Quality Management Strategy (NWQMS): Implementation Guidelines (ANZECC & ARMCANZ, 1998) and the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ, 2000) and include:

- aquatic and terrestrial ecosystems
- primary industries including stock drinking water, irrigation and general water uses
- recreation and aesthetics
- cultural and spiritual values.

The beneficial uses and sensitivity of the surrounding land use and environment as declared under the *Water Act* and set out in the MRM WDL include:

- Declared beneficial uses and or water quality objectives:
 - McArthur River Area: Aquatic ecosystem protection, recreational water quality and aesthetics
 - McArthur River Catchment Area: Environment, cultural and riparian
- Sites of Conservation Significance (SOCS):
 - SOCS Number 33: Sir Edward Pellew Island Group
 - SOCS Number 34: McArthur River coastal floodplain
 - SOCS Number 35: Borroloola area.

The Proponent classifies the condition of the McArthur River in the vicinity of the mine as a Level 2: slightly to moderately disturbed ecosystem, in accordance with ANZECC

(2000) guidelines. The NT EPA accepts that the presence of the mine and the diversion of the river, as well as pastoral activities, has led to a moderate level of disturbance to the River at this reach and considers that the diverted reach of the river and remnant channels should be regarded as highly disturbed. Even so, it is important that a high level of water quality is maintained in the whole of the McArthur River, and the less disturbed river reaches are protected from further degradation as a result of mining activity. The McArthur River diversion channel and the remnant channel sections are regarded as being part of the McArthur River.

The Proponent has not yet ascribed values or closure objectives to the tributaries on the mine site due to the seasonal occurrence of mine-derived impacts within their lower reaches. Surprise and Barney Creeks have both been modified to facilitate mining and are used as mine water interception and containment structures, to some degree. The current disturbance to waterways on the mine site as a result of the mine is accepted but the NT EPA considers that there must be a long term plan to remediate these creeks.

The Proposal is currently not within a declared water allocation planning area under the *Water Act*. There are no privately owned bores within a 5 km radius of the mine; all bores within this 5 km buffer are owned by the mine. Downstream of MRM, regional drinking water supplies are not derived from the McArthur River and come from sources that are not hydraulically connected to waters affected by the Proposal.

The EIS states that the mine site does not contain any non-mine related environmental values for groundwater. However, within the mining lease there are a number of waterholes that rely on groundwater baseflow during the Dry season to maintain water levels. Djirrinmini waterhole, a culturally-significant waterhole on the McArthur River upstream of the McArthur River diversion channel, is one such perennial surface water feature.

5.1.3 Potential impacts

The following impacts on inland water environmental quality may occur as a result of past and current mining activities at the MRM site, and the implementation of the Proposal:

- groundwater aquifers impacted by sulfate and metal/metalloids as a result of AMD seepage from mine infrastructure
- waterways impacted by contaminated groundwater
- waterways impacted by dust and runoff from contaminated mine areas.

Poor quality water from the mine site as a result of the Proposal has the potential to report to the McArthur River either directly or via its tributaries including Surprise Creek and Barney Creek, and, in the longer term, Emu Creek.

5.1.4 NT EPA assessment

The Proponent's objectives for managing surface water and groundwater focus on maintaining environmental values and ecosystems downstream of the mineral lease boundary in the short term (as a requirement of its Waste Discharge Licence), and within the McArthur River in the long term.

The NT EPA's overarching environmental outcome in Recommendation 3 is to ensure the health of the McArthur River along its whole length at all times from mine related impacts by ensuring that the annual loads of lead and zinc discharged to the McArthur River in future years (July to June) do not exceed the loads discharged in 2017-2018, taking into account seasonal variations in rainfall, and subject to future load calculations. Managing activities to meet this overarching environmental outcome is likely to satisfy the NT EPA's objective for inland water environmental quality.

The NT EPA considers that to meet the NT EPA's overarching environmental outcome, water quality in the McArthur River must be maintained within site-specific trigger values determined in accordance with ANZECC (2000) guidelines at appropriate monitoring locations. This assessment will focus on the NT EPA's view that to meet the overarching environmental outcome, the Proponent will need to strengthen its management approaches for avoiding impacts to water quality in the McArthur River with implementation of avoidance and mitigation activities at the source.

Recommendation 4

The Proponent shall implement all stages of the Proposal to meet the NT EPA's overarching environmental outcome provided for in Recommendation 3 to the satisfaction of the relevant regulator. In doing so, the Proponent shall ensure:

- i. water quality in the McArthur River meets site-specific trigger values determined in accordance with ANZECC (2000) guidelines at appropriate monitoring locations determined in accordance with Recommendation 13**
- ii. creeks on the mine site show long-term improving trends in water quality within 20 years after cessation of mining.**

5.1.4.1 Mine-related impacts on environmental quality of the McArthur River

Stakeholder submissions raised concerns that the mine is currently a source of pollution and that pollution is likely to increase with ongoing operation of the mine. Further concerns raised include the uncertainties around the capacity of soils and aquifers to continue buffering acidic drainage and bind metals, the modes of groundwater transport from the site and its interception, and the long-term stability and integrity of the NOEF.

In this assessment the NT EPA has identified the key contaminants associated with the Proposal; examined the sources of those contaminants; considered the pathways for contaminants to the McArthur River and its environmental values (receptors); and considered avoidance and mitigation measures to reduce impacts and risks to as low as reasonably practicable.

As part of this assessment, the NT EPA examined all available water quality data and biological monitoring results for the McArthur River. These data show that in the McArthur River the water quality remains satisfactory, aquatic life is unaffected (as far as the monitoring data could determine) and the fish are safe to eat.

There has been a significant deterioration in groundwater quality and the water quality of creeks on the mine site. The NT EPA accepts that some deterioration in water quality on the mine site has occurred due to mining activities, but expects these waterways to be rehabilitated following cessation of mining. Further, there is a large amount of metal-bearing tailings and waste rock stored on the site. Thus, committed management of these risks is essential to avoid a future deterioration in water quality in the river.

Contaminants of concern

The Proponent established a suite of CoCs for its modelling, representative of mine pollution sources (sulfate, lead, zinc, cadmium and arsenic – see Table 2).

Additionally, there are a range of other physico-chemical and metals/metalloid indicators that the Proponent continues to monitor as part of its water quality monitoring program.

The interaction of these CoCs with the geology and groundwater of the mine site determines their mobility in ground and surface waters. Sulfate is conservative, that is, it reacts slowly in aquifers and moves relatively freely in groundwater. It therefore

represents the maximum extent to which a CoC is expected to migrate as a predictor of mine-derived pollution in the modelling. However, sulfate is not considered to be an acute threat to McArthur River water quality, which can contain seasonally high salt levels in isolated pools in its freshwater reaches and is saline in its tidal reaches approximately 60 km downstream of the mine.

Metals, particularly lead, are considered more of a concern due to their potential toxicity in aquatic systems at high levels. However, the carbonate-rich nature of the waste rock and groundwater aquifers in many areas, and the neutral to slightly alkaline pH of the water, are currently limiting the solubility and therefore mobility of most metals. The Proponent expects that the partially oxidising nature of the flow paths will also allow for precipitation of potential minerals that can further attenuate metal concentrations (draft EIS Appendix T; Supplement Appendix L). Significant attenuation of key metals appears to be occurring in aquifers under the mine site at present which appears to be restricting the extent of plumes of metals in groundwater contaminated by mine infrastructure. The groundwater system is not well enough understood to presume that this attenuation will always occur.

Sources and pathways

The sources of CoCs and their pathways to environmental receptors can be understood largely by the interaction between surface water and groundwater systems on the MRM site. Surface waterways are the predominant pathway for contaminant transport in the Wet season, and groundwater is the key migration pathway for contaminants in the Dry season. The EIS indicates that all active groundwater beneath the mine site flows towards surface water features with local shallow flow to creeks on site and deeper regional flow to the McArthur River, which is the major regional sink for groundwater.

Contaminated groundwater is the predominant contributor of mine-derived pollution to waterways down gradient from contaminant sources during the Dry season. While surface water runoff from the various mine landforms also contributes, these flows are generally captured in the mine's water management system and any fugitive runoff tends to be substantially diluted by regional surface water flows during Wet season rain events.

Contamination of water on the mine site occurs principally from infiltration of rainfall into the NOEF, TSF and other mine waste landforms, where it comes into contact with non-benign waste material and percolates into groundwater or surfaces at the base of landforms as toe seepage.

Predictions of water quality at receptors down-gradient of the mine site were made using a series of models including a site-wide groundwater flow and solute transport model (draft EIS Appendix T) and a waterways model (Supplement Appendix N). Modelling was updated for the Supplement in response to issues raised in the review of the draft EIS.

The NT EPA's independent expert considers that the reliability of the recent groundwater modelling has improved from modelling presented in the draft EIS and is generally considered to be of a high standard. The approach taken for the waterways model was deemed suitable (ERIAS Group, 2018; IM, 2017).

The reliability of predictions from the model is limited by:

- the hydraulic properties of fractured rock aquifers, which generally control groundwater flows across the mine site
- the long-term effectiveness of metals attenuation in the aquifers, which may be less in discrete groundwater flow pathways
- impacts of climate change

- the actual performance of proposed management strategies for controlling seepage and runoff from the NOEF and TSF, particularly after closure (discussed in subsequent sections of this Report).

Some of these uncertainties can be reduced through targeted investigations and a co-ordinated monitoring program during mining operations. Site-specific data must be incorporated into models with review and recalibration of modelling conducted on a regular basis.

In order to inform decision making for the Proposal, the NT EPA recommends an ongoing commitment to review and validate modelled predictions.

Recommendation 5

Approvals and decisions in relation to the Proposal shall include conditions that require the Proponent to calculate contaminant loads and contaminant concentrations entering creeks and the McArthur River using models that have been regularly reviewed and recalibrated.

Specific assumptions to be tested include but are not limited to:

- i. **groundwater flow paths**
- ii. **attenuation of metals from mine-derived wastes.**

Updated modelling shall use suitable site-specific data collected in the monitoring program. Models and modelling outputs, and the data collection programs to inform model updates, shall be reviewed at three year intervals by relevant independent panels appointed in accordance with Recommendations 8, 11 and 23, and the outputs used to inform the Adaptive Management Plan, to be developed in accordance with Recommendation 28.

Geochemical testing and materials classification

The NT EPA's independent expert advised that the MRM deposit includes strongly pyritic materials, and mine waste geochemistry (and its implications) is considered to be the most significant environmental risk for the site. Preventing adverse impacts on the receiving groundwater and surface water environments, and ensuring rehabilitation success, requires a thorough understanding of the AMD potential of mine materials (including waste rock, tailings, open cut walls/void and stockpiles) and development of appropriate management strategies to mitigate current mining impacts, and future impacts during operations and closure.

As discussed previously, a key aspect of the change in the understanding of the MRM geochemistry was the acknowledgement by the Proponent that the previous waste rock classification system did not adequately segregate all problematic materials (discussed in Section 1.1.1 of this Report). The current classification system expands on the previous NAF and PAF criteria, and takes into account the presence of sulfidic NAF materials that have potential for neutral drainage with elevated salinity and/or metals/metalloids, and highly sulfidic and reactive materials that have potential for self-heating.

The NT EPA's independent expert reviewed the Proponent's geochemical testing regime and classification system and advised that the geochemical properties of overburden and tailings at the mine are now better understood and that the classification system is generally well justified and can be expected to be reliable. However, continued verification of materials and validation of block modelling will be required.

A comprehensive quality assurance/quality control (QA/QC) program must be maintained. Incidents that have occurred at the mine in the past with waste placement

can largely be attributed to QA/QC deficiencies. In recent years, the Proponent has improved its QA/QC process for geochemical sampling and overburden placement. Based on advice from its independent expert, the NT EPA considers that the current and proposed system of materials segregation and handling at the mine is an improvement from past practice. The Proponent has conducted substantial investigations and modelling to understand the geology and predict its overburden disposal requirements, and has made significant changes to correct deficient overburden handling processes. Continual verification of modelling and improvement of the QA/QC system should be ongoing as part of the Proponent's Environmental Management System and Adaptive Management Plan. Audits of the QA/QC systems and overburden handling procedures must be conducted by an independent, appropriately qualified professional.

Recommendation 6

Approvals and decisions in relation to the Proposal shall include conditions that require an audit to be conducted of the Proponent's Quality Assurance / Quality Control procedures and waste rock identification and handling performance every three years and reported to the relevant independent panel and the relevant regulator.

AMD from the Northern Overburden Emplacement Facility Domain

The seepage of AMD following oxidation of PAF wastes stored within the NOEF is one of the main risks to the groundwater environment at the site (ERIAS Group, 2017). The potential for the proposed larger NOEF to be a source of contamination into the long term is a significant concern for the NT EPA and most stakeholders.

To date, the Proponent has managed water on the site within the existing storages and evaporation basins without causing a significant impact on the McArthur River downstream of the mine. Provided this degree of management effort continues, and more water management facilities are constructed to cope with the larger runoff and seepage expected from an expanded NOEF, contaminated surface runoff is considered to be manageable during operations.

Poor-quality seepage, however, is expected to continue migrating through the base of the NOEF and underlying shallow geology, and enter the Barney Creek diversion and old McArthur River channel as groundwater baseflow well into the future.

As discussed in Section 1.3.3.2 of this Report, water quality monitoring indicates that seepage and runoff from mine infrastructure reports to the McArthur River periodically but that CoC concentrations, as measured at the downstream site SW11 (nominated in the Waste Discharge Licence), are not at levels that would impact the downstream environmental values. At the cessation of mining, and through phases of closure and rehabilitation, the Proponent proposes that ongoing active management will be required to prevent unacceptable impacts off the mine lease. To meet the NT EPA's overarching environmental outcome of protecting the environmental values of the McArthur River throughout the mining period and during closure and rehabilitation, the NT EPA considers that mine site groundwater and water quality in creeks must trend towards recovery following cessation of mining in accordance with Recommendation 4 of this Report.

There are three important controls that can be applied in the design of the NOEF to minimise AMD from the NOEF and hence contribute to reducing the migration of contaminated groundwater to creeks, and achieving the NT EPA's overarching environmental outcome:

1. control seepage during operations
2. control advection and hence limit reactions in the waste rock

3. reduce long term seepage using a cover system.

1. *Control seepage during operations*

There are a number of ways that the Proponent intends to control seepage through the NOEF during mine operations. The key approaches are the design and staged construction of the new NOEF. The Proponent's proposal to raise the height of the NOEF from 80 m to 140 m to minimise the footprint would reduce the potential volumes of seepage that would otherwise occur with a lower height, with a further benefit of reduced runoff. The NT EPA considers that the increased height would have environmental benefits but acknowledges that the proposed increase introduces cultural sensitivities.

The NT EPA believes there may be some flexibility in the design that allows for modifications that result in small changes in the footprint extent to reduce encroachment of the NOEF on culturally sensitive areas while still meeting all environmental objectives. Further negotiations between the Proponent, the custodians and AAPA are required to resolve cultural concerns with the proposed NOEF design, as discussed in Section 5.4.4.1. If required, the NT EPA or its representatives could be available to further explain the environmental issues to be managed in any negotiation.

The NOEF is proposed to be closed and progressively rehabilitated in stages sequenced to occur indicatively every two to six years for each stage, commencing with Stage 2 in 2020. The staged approach will reduce the working area of the NOEF exposed to rainfall infiltration at any particular time and should provide sufficient time for the site operator to observe, monitor and learn from the actual runoff and seepage outputs of completed sections. The NT EPA supports a staged approach and considers that progressive covering, sealing and rehabilitation of the NOEF is essential.

Before the proposed final cover system is installed, substantial rainfall infiltration into the exposed dump surfaces will occur. Compacted alluvium used for advection barriers on PAF cells during construction is reported to reduce infiltration (by around 50%) (IM, 2017) as will the shaped geometry, staged construction and progressive rehabilitation of the NOEF.

However, AMD from PAF waste will continue to be generated during staged construction of the NOEF and is likely to percolate through the base into groundwater. Management of seepage through the NOEF during mining operations will be critical in minimising the amount of contaminated water to be handled at the site.

Toe seepage from the NOEF reports to four existing dams (PRODs). Seepage through the base of the NOEF and historical leakage of PRODs has contaminated aquifers beneath and down-gradient of these structures. This contaminated groundwater expresses as baseflow to Surprise Creek, Barney Creek diversion and the old McArthur River channel, which currently act as interception drains. The potential for seepage from the dams and associated drains from the NOEF has been or will be reduced through the installation of liners.

The main barrier to minimise seepage from the NOEF to underlying groundwater aquifers is the base layer. The foundation of new stages of the NOEF will comprise compacted in-situ clay or a constructed clay liner, originally proposed in the draft EIS to be 0.5 m thick, and proposed in the Supplement to be 0.25 m thick. The thickness of the proposed basal clay liner was halved since the draft EIS, due to the Proponent's proposal to install a geo-synthetic liner (GSL) rather than a clay liner in the cover system. The NT EPA acknowledges that installation of a GSL cover has the potential to significantly improve cover performance compared to a clay liner. However, the NT EPA considers that a precautionary approach must be taken as the performance of the cover system has not been demonstrated at this stage and it will not be possible to re-work the foundation when the NOEF is completed. Implementation of a 0.5 m thick compacted

clay layer as originally proposed would reduce seepage through the base and therefore reduce the contaminant load to groundwater during mine operations and thereafter.

Recommendation 7

The basal layer of the NOEF foundation shall be constructed with a compacted clay layer of at least 0.5 m thickness to limit seepage to groundwater during construction of the NOEF.

Seepage that percolates through the NOEF base to groundwater migrates through permeable pathways that have been identified in the underlying aquifers by particle tracking. The major long-term groundwater pathway for NOEF seepage is south towards Surprise Creek and the Barney Creek diversion through permeable overburden and weathered bedrock. Another significant pathway flows eastward from the central and eastern NOEF towards the Cooley Dolomite. The Cooley Dolomite and Western Fault fracture corridor may be limited by an impermeable barrier of bedrock associated with Damangani (Barramundi Dreaming), providing a preferential southward conduit to either the Barney Creek diversion, the old McArthur River channel or the open cut (Supplement Appendix L). Emu Creek to the north of the NOEF also has the potential to be impacted when the proposed NOEF reaches its full northern extent and if groundwater mounding occurs beneath the NOEF (draft EIS Appendix T).

Modelling conducted for the EIS (draft EIS Appendix T and Supplement Appendix L) indicates a sulfate plume between the NOEF and Barney Creek diversion/old McArthur River channel in the long-term (Figure 13) but slower migration of metals due to attenuation processes in the aquifer. Metals migration is expected to continue into the very long term though, with the extent and concentration of the zinc plume continuing for 1000 years in the model predictions (Figure 14).

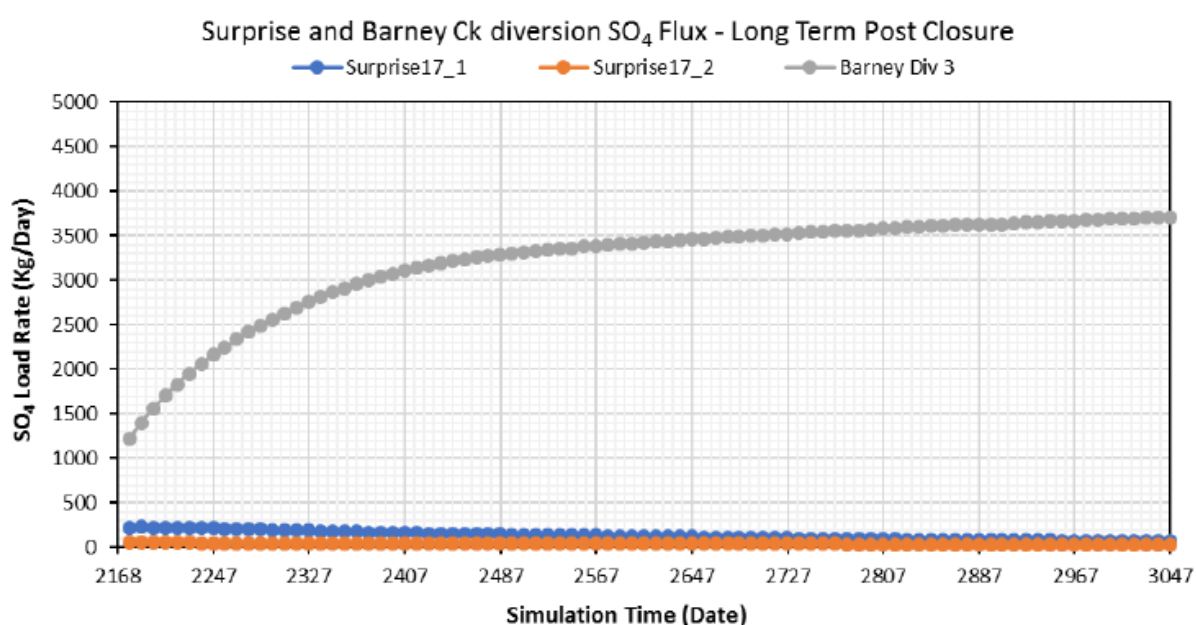


Figure 13: Sulfate load predictions for Surprise Creek and Barney Creek diversion in the long-term (From Supplement Appendix L Figure A1-14)

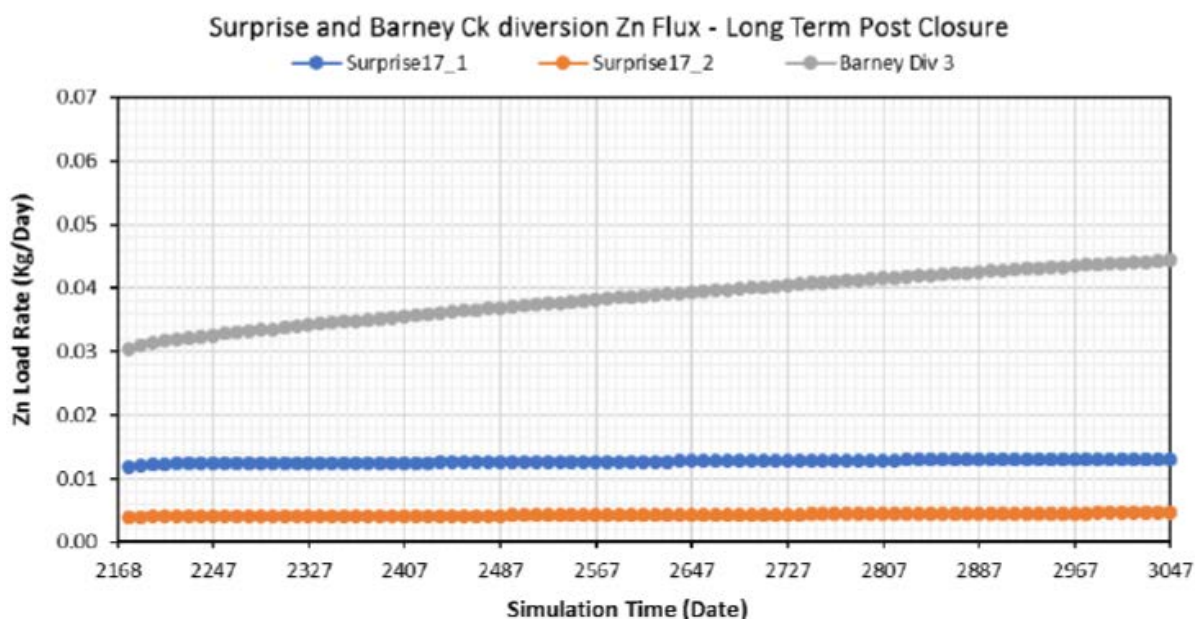


Figure 14: Zinc load predictions for Surprise Creek and Barney Creek diversion in the long-term (From Supplement Appendix L Figure A1-15)

The NT EPA's independent expert advises that there is significant uncertainty in the long-term effectiveness of attenuation in minimising migration of metal contaminants in groundwater. The NT EPA has made Recommendation 5 to ensure that groundwater modelling is regularly updated and re-calibrated to reflect monitoring results and the groundwater monitoring program must be capable of testing the modelling assumptions. The updated modelling should be used to predict whether or not the outcome meets the NT EPA's overarching environmental outcome that metal loads to the McArthur River should not increase, in accordance with Recommendation 3.

The Proponent proposes to intercept groundwater seepage at Barney Creek and recover it using a collection sump in the Barney Creek diversion and a sump (BCS2) (proposed for the old McArthur River channel downstream from the Barney Creek diversion) to help meet off-lease surface water quality commitments at SW11. Given the concerns about the location of SW11 (Section 5.1.4.2) and the proposal to locate the BCS2 sump in the McArthur River just upstream from the active channel/diversion confluence, there is the potential that the NT EPA's overarching environmental outcome in Recommendation 3 will not be met.

The Proponent's NOEF Independent Review Board (NIRB) recommended the installation of interception bores and/or trenches to capture basal seepage from the NOEF and its PRODs before it reaches the waterways. Modelling predicts that the CoC loadings from the NOEF can largely be prevented from entering the Barney Creek diversion by installing an interception trench and extraction bores (Supplement Appendix L).

While an interception trench/bores would still require ongoing management, the NT EPA is of the view that the Proponent's strategy to capture seepage in the old McArthur River channel sump is not sustainable and continued pollution of Barney Creek diversion and the old McArthur River channel is likely to extend the time taken for the creek and shallow groundwater aquifers to recover from contamination.

The NT EPA strongly supports the consideration of methods to actively intercept groundwater from the NOEF before it reaches Barney Creek diversion and the old McArthur River channel and considers that such intervention could enable the Proponent to meet the NT EPA's overarching environmental outcome, at least in the short term. The groundwater interception modelling and system design should be reviewed by an

appropriately qualified, third party/independent panel of experts. In this respect, the NT EPA considers that an independent panel of experts would replace the current arrangements for the Proponent's NIRB.

Any resultant changes in the design should be included in updated modelling and subsequent results used to update the Adaptive Management Plan, to be developed in accordance with Recommendation 28.

Recommendation 8

Approvals and decisions in relation to the proposal will include conditions requiring the Proponent to provide funding to establish and operate a panel of independent experts to:

- i. review every three years the outcomes of the Proponent's management program for the NOEF, including the stability, surface condition, internal temperature, reactions and seepage quantity and characteristics of the NOEF to ensure the overarching environmental outcome can be met**
- ii. review NOEF runoff and seepage monitoring results, and in particular trends in the contaminant concentrations in groundwater, and loads entering creeks and the McArthur River**
- iii. review the cover trial results, construction quality records, critical controls, stability assessments, cover performance and performance of progressive rehabilitation of the NOEF.**

The panel shall provide a report every three years to the relevant regulator and the Independent Monitor and the report made available to the Proponent, government agencies, the Community Reference Group and the public.

The panel is to be formed:

- iv. with an independent chair, appointed by the responsible Minister in consultation with the Minister for Environment and Natural Resources**
- v. on the advice of the Department of Environment and Natural Resources, the Department of Primary Industry and Resources, and the Proponent.**

Terms of Reference for the panel shall set out the terms for roles and responsibilities, membership, timeframe for commencement and scope, reporting obligations and transparency and accountability. The Terms of Reference shall be finalised by the responsible Minister, in consultation with the Minister for Environment and Natural Resources acting on advice from the NT EPA, within three months of authorisation of the Proposal.

The structure of the panel and its Terms of Reference shall be reviewed by the Responsible Minister, in consultation with the Minister for Environment and Natural Resources every six years from the date the Terms of Reference are finalised.

Recommendation 9

Approvals and decisions in relation to the Proposal shall include conditions that require the Proponent to implement a groundwater interception and recovery system for the NOEF. The system is to be designed to:

- control seepage to Barney Creek diversion and the McArthur River over the life of the NOEF to as low as reasonably practicable**

- achieve a recovering trend in the Barney Creek diversion and the old McArthur River channel water quality within 20 years of cessation of mining.

The system design and performance shall be reviewed by the independent panel, appointed in accordance with Recommendation 8, and approved by the relevant regulator/s.

2. Control of advection

Advection control is the second barrier to avoid or minimise generation of AMD in the NOEF. Advection leads to reactions within the stored rock that generate AMD and in the case of some strongly pyritic PAF(RE) rock types, spontaneous combustion. Current measures for control of advection in the NOEF (Central West stage) involve placement of PAF(HC) and PAF(RE) waste rock in 2 m lifts to limit air permeability, and placement of compacted alluvium as advection barriers on inter-stage faces of the NOEF with an MS-NAF halo providing a further barrier to oxygen flow. In the older dump areas, PAF materials were generally end tipped in lifts of approximately 15 m, resulting in segregation of coarse and fine materials and creation of chimney structures that encouraged rapid convective oxidation and acid generation. Remediation of the existing NOEF PAF cells to stop and prevent further spontaneous combustion has been ongoing since 2014, involving:

- excavating, cooling and rehandling actively combusting material
- reconfiguring berms and outer batter slopes of the NOEF to remove preferential air pathways and limit advection of air into the stockpile, completed along the northern batter of the NOEF in September 2017
- placement of a barrier on the batters and plateau of the NOEF to further reduce bulk air transport into the stockpile.

The NT EPA requested evidence that the remediation strategy was working. Additional information was provided by the Proponent on its advection control strategy and monitoring program. Monitoring results show that spontaneous combustion has largely been eliminated in the old NOEF and temperatures have cooled (Figure 15).

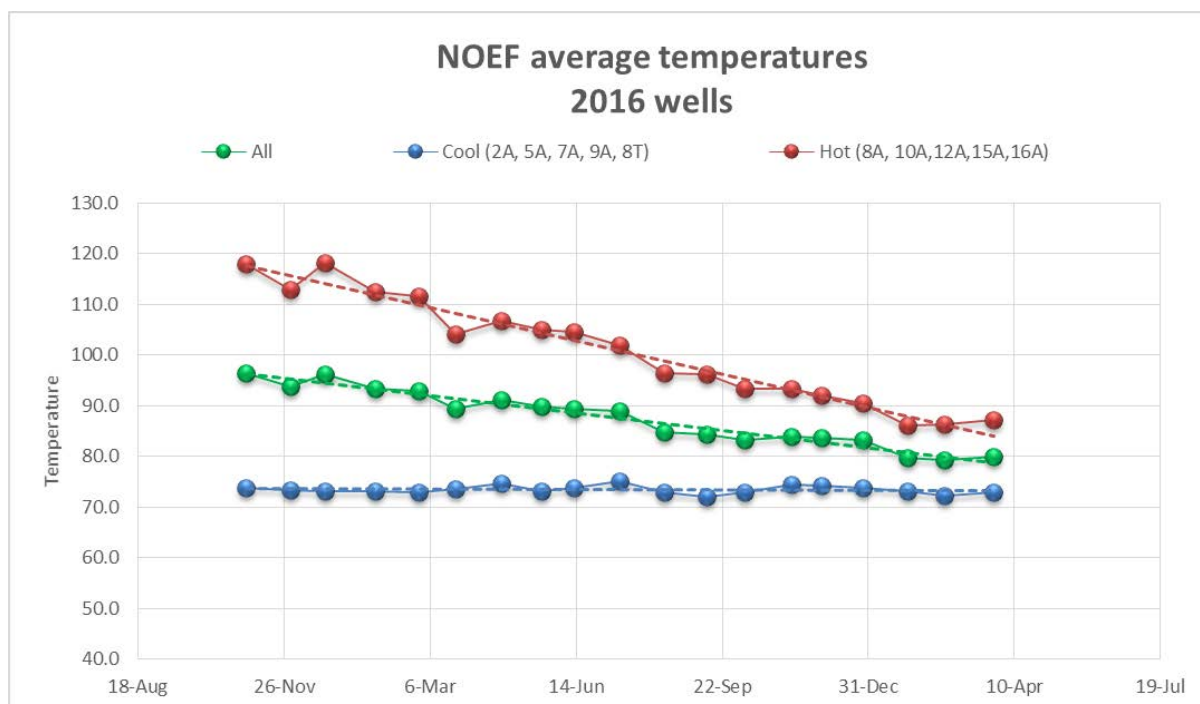


Figure 15: Average monthly temperatures (°C) for 10 temperature wells installed in 2016 (From additional information provided to the NT EPA)

The NT EPA acknowledges that the Proponent has undertaken substantial efforts to halt the spontaneous combustion in the older NOEF PAF cells, which appear to be effective, noting also that during several site visits no ‘smokers’ were observed. Nonetheless, average temperatures in the dumped material are still considered high at over 70°C, which is an indication that rapid oxidation rates and AMD generation are still occurring. These temperature gradients in the NOEF are likely to continue driving the convective oxidation process so that any water infiltrating PAF cells in the future can mobilise oxidation products.

The NT EPA considers the advection management measures and their continued use in the development of the NOEF are essential as part of the overall barrier strategy. Continued monitoring will be required to determine the ongoing effectiveness of controls, particularly during the rehabilitation of the existing NOEF.

3. Reduce long-term seepage using a cover system

The third barrier to limit generation of AMD in the NOEF is the installation of a low-permeability surface cover to control long-term net percolation of water through the NOEF. A number of significant issues were identified in the draft EIS review with the appropriateness of a proposed clay liner as the low-permeability cover material. In response, the Proponent presented an alternative cover design in the Supplement, which included replacement of the clay liner with a geosynthetic liner.

Geosynthetic liners, such as high density polyethylene (HDPE) and bituminous geomembrane (BGM) should provide effective infiltration control over the short and long term if properly constructed (ERIAS Group, 2018). This is supported in a report by O’Kane Consulting for the EIS (Supplement Appendix G), which indicates very low values of net percolation (less than 5% of rainfall) can be achieved under certain conditions. This suggests that if a geosynthetic liner is properly installed over the entire NOEF, infiltration rates and thus the seepage source would be significantly reduced and groundwater quality beneath and downgradient from the NOEF would eventually recover. Modelling predicts that toe seepage would reach very low levels in the long-term, reducing to almost zero within 20 years of the geosynthetic cover placement (Supplement Appendix K). The NT EPA considers that these are admirable aims and

strongly supports testing various cover materials. Successful demonstrations are still in the future.

The long-term performance of a geosynthetic liner cover will be subject to many variables including:

- quality of construction
- protection from sunlight and weather
- degradation of the liner
- temperature effects from existing and ongoing convection from inside the NOEF
- differential settlement
- vegetation cover
- slope stability.

The NT EPA considers that cover trials will be necessary to investigate the importance of the variables listed above to the proposed cover performance and to determine the most effective geosynthetic liner type (e.g. HDPE, LLDPE, BGM and EPDM (Supplement Appendix H)) to achieve the Proponent's long-term closure objectives, and the NT EPA's overarching environmental outcome. Any trials should be reviewed by the independent panel, appointed in accordance with Recommendation 8, and inform the Adaptive Management Plan to be developed under Recommendation 28, and the use of the most effective cover material in the final NOEF cover.

Recommendation 10

Approvals and decisions in relation to the Proposal shall include conditions that require the Proponent to undertake constructability tests for geosynthetic liner cover options, including a geosynthetic liner /compacted clay layer combination, and monitor the options on rehabilitated stages of the NOEF to determine all relevant performance parameters including:

- **slope stability during extreme events**
- **cover performance as a result of heat effects**
- **tolerance of the geosynthetic liner to expected differential settlement**
- **veracity of cover longevity predictions**
- **likely long-term maintenance requirements.**

Reporting of trial results and monitoring outcomes shall be provided every three years to the relevant independent panel and the Community Reference Group for review, and shall be audited by the Independent Monitor. Outcomes of trials and monitoring shall be used to inform the Adaptive Management Plan, to be developed in accordance with Recommendation 28, and the Closure Plan for the mine.

The timing of trials and staging of NOEF construction must include allowances for contingency interventions in the event that installed covers do not perform as predicted, including consideration of removing the worst material from the existing NOEF for appropriate alternative disposal.

Acceptable contingency interventions based on best available technology and practice must be included in the Adaptive Management Plan, to be developed in accordance with

Recommendation 28, so that they can be implemented within a time frame that avoids target trajectory failure.

AMD from the Tailings Storage Facility Domain

The TSF is an existing source of AMD into Surprise Creek and Barney Creek and is considered a major geochemical risk to water quality in the McArthur River. The tailings are planned to be re-processed and disposed of in the pit after mining ceases. This would remove any geotechnical risk and transfer geochemical risk other than a residual plume from the TSF domain to the pit, as discussed later in this Report. Management of potential impacts associated with the TSF will therefore be an issue only until re-processing of the tailings is completed.

The Proponent's preferred option for continued tailings deposition at the TSF during mining is to combine cells 1 and 2, construct upstream wall raises and deposit tailings in accordance with current practice. The plan has the benefit of limiting the area of disturbance to the current footprint for the projected economic LOM (to 2037), rather than developing new cells over a wider area. This will require raising the TSF by 10 m from its current authorised height. These changes will be included in the MMP and considered by the regulator.

The NT EPA is concerned about the risk of catastrophic failure of TSF containment, raised as an issue by the IM in a number of its audit reports (IM, 2016). While current tailings deposition practices may have reduced the potential for embankment failure, the NT EPA considers that this matter will be a component of the periodic review by the independent panel, as provided for in Recommendation 11.

A high moisture content must be maintained in the tailings to prevent AMD generation and spontaneous combustion. On the other hand, excessive water in the tailings leads to increased groundwater mounding and seepage to waterways. The Proponent has undertaken significant investigations to improve its understanding of tailings and their management at the TSF.

A recent review by the Proponent, of water quality at the TSF, suggests that high sulfate levels and metal concentrations in cell 2 appear to originate from CoCs in process water rather than from tailings oxidation products. Cell 1 is currently inactive and has been capped. Since it is not receiving fresh tailings and the capping is temporary and damaged in some places (IM, 2016), the tailings may be unsaturated and oxidising, with CoCs flushed from cell 1 during the Wet season (ERIAS Group, 2018). The possibility of contaminated seepage from the TSF reporting to Surprise Creek and Barney Creek – perhaps as a combination of AMD from cell 1 and process water from cell 2 – is a matter of regular investigation by the Proponent.

The Proponent has implemented and proposed additional measures to control the quality and quantity of water reporting to the TSF. These include minimising ponding, strictly managing tailings beaching, maintaining a small decant pond, reclaiming tailings consolidation water, and recycling rather than discharging water from part of the processing circuit. The proposal to combine cells 1 and 2 would see fresh saturated tailings placed over cell 1, which is likely to greatly reduce any oxidation currently occurring (but will increase hydraulic loading). The NT EPA considers that CoC source control is critical and is strongly supportive of measures to reduce hydraulic loading and CoC concentrations of water in the TSF.

Groundwater modelling undertaken by KCB in 2016 (Appendix I in draft EIS Appendix T) is considered by the NT EPA's independent expert to be reasonably robust. It predicted that sulfate loads to Surprise Creek, if unmitigated, would increase with development of the TSF and could reach ~3500 kg/day by 2037 causing a mixed baseflow concentration from groundwater of ~2000 mg/L of sulfate, and increasing in the longer term along the length of Surprise Creek from the TSF down to the highway bridge.

The modelling simulated the effects of an interception trench installed with a base elevation 1 m below the bed of the adjacent Surprise Creek. The modelling predicts the trench will intercept 61-75% of sulfate. Deepening the trench by another metre is predicted to improve recovery by a further 10-15%. Even so, loads of sulfate to the creek are expected to gradually increase to 2000 kg/day over the LOM despite the interception trench, due to the creek's proximity to cell 1 and the hydraulic loading in the TSF. This sulfate load is predicted to diminish rapidly during proposed in-pit tailings disposal and approximately 100 years after removal of the TSF the sulfate load in Surprise Creek is predicted to have declined to near background loads. Based on this and other information presented in the EIS, the NT EPA considers that moving the tailings to the pit following completion of mining is essential.

The NT EPA is of the view that all contaminant sources should be reduced to as low as reasonably practicable, and to minimise pollution from the TSF to waterways during operations, flow pathways should be blocked. The strategies proposed in the EIS are considered likely to reduce seepage to waterways during construction, reduce the contaminant loads in seepage, and therefore the timeframe for recovery of the aquifers and waterways, which in combination should further reduce long term impacts to the McArthur River.

The Proponent's groundwater interception modelling and system design should be reviewed by an appropriately qualified, third party panel, replacing the current arrangements for the Proponent's Independent Tailings Review Board (ITRB). The Proponent's groundwater monitoring program should also be reviewed by the recommended panel to ensure it is able to determine the efficacy of seepage controls, and to detect impacts to sensitive receptors further afield. The outcomes of the review including development of appropriate contingency interventions if benefits are not fully realised, will need to be built into the Adaptive Management Plan (Recommendation 28).

Recommendation 11

Approvals and decisions in relation to the proposal will include conditions requiring the Proponent to provide funding to establish and operate a panel of independent experts to:

- i. review every three years the outcomes of the Proponent's management program for the TSF including the berm stability, risk of overtopping, seepage and other aspects of the TSF that could impact on site water quality and the McArthur River, including critical controls and the risk of catastrophic failure of any component of the TSF, to ensure that the overarching environmental outcome can be met**
- ii. review TSF seepage monitoring results and the appropriateness of the monitoring program.**

The panel shall provide a report every three years to the relevant regulator and the Independent Monitor and is made available to the Proponent, government agencies, the Community Reference Group and the public.

The panel shall be formed:

- iii. With an independent chair, appointed by the responsible Minister in consultation with the Minister for Environment and Natural Resources.**
- iv. on the advice of the Department of Environment and Natural Resources, the Department of Primary Industry and Resources, and the Proponent.**

Terms of Reference for the panel shall set out the terms for roles and responsibilities, membership, timeframe for commencement and scope, reporting

obligations and transparency and accountability. The Terms of Reference shall be finalised by the responsible Minister, in consultation with the Minister for Environment and Natural Resources acting on advice from the NT EPA, within six months of authorisation of the Proposal.

The structure of the panel and its Terms of Reference shall be reviewed by the Responsible Minister, in consultation with the Minister for Environment and Natural Resources every six years from the date the Terms of Reference are finalised.

As discussed previously, the most significant measure for the control of long-term, on-going contamination of groundwater as a result of the tailings domain is considered to be the Proponent's preferred closure strategy, the disposal of tailings in the mine pit void. The IM (2017) indicated that it *strongly supports the re-processing and in-pit disposal option proposed in the Draft OMP EIS, which would ensure that the tailings remain inundated in the long term, thereby preventing further sulfide oxidation and providing a much more secure closure outcome than would be achieved for a TSF with a cover system*. This view is also supported by Noller (2017), the ITRB, and the EDO, ECNT and NLC.

In consideration of the PAF(HC) classification and potentially high reactivity of tailings when desiccated, the NT EPA considers that above-ground tailings storage at MRM into the long term constitutes an unacceptably high risk to the McArthur River and its catchment given the risk of structural failure and consequent potential for contamination. The NT EPA is of the view that depositing the tailings in the pit void using appropriate placement methods and a water cover is absolutely critical to meeting its overarching environmental outcome for the McArthur River in the long term. The NT EPA would prefer that the tailings are reprocessed to remove additional metals prior to in-pit disposal.

Recommendation 12

As soon as practicable after cessation of mining, tailings and other contaminated earthen materials from the Tailings Storage Facility shall be deposited in the mine pit void using contemporary best-practice placement techniques, then protected with a water cover. Tailings shall preferably be reprocessed before in-pit disposal.

The intention of these measures is to protect the McArthur River water quality and aquatic ecosystems from surface or groundwater contamination consistent with the NT EPA's overarching environmental outcome in Recommendation 3. Any requirement to vary these measures will need approval from the relevant regulator and notification to the NT EPA in accordance with Recommendation 2. These measures should only be varied on the basis of further information to inform leading practice.

Recovery of the TSF site following removal is expected to be relatively rapid. Groundwater modelling predicts that seepage will progressively reduce, becoming negligible by 2047, although this timing will depend on the rate and success of decontamination of the TSF site.

If a land-based closure option for the TSF is proposed by the Proponent in the future, the NT EPA must be notified in accordance with Recommendation 2 of this Report for a decision on whether or not further environmental impact assessment will be required.

AMD from the mine pit domain

Groundwater on the mine site flows regionally towards the McArthur River, and locally towards the ephemeral creek systems. Plumes are influenced by the drawdown zone for pit dewatering and much of the groundwater migrates into the open pit/underground

mine groundwater system. The groundwater flow and solute transport model predicts that this drawdown effect becomes more pronounced as mining progressively deepens the pit.

Pit inflow rates are predicted to vary over the LOM as the pit deepens and are expected to be highest during the early mining stages, with variable peaks where faults and more permeable aquifers are intersected, and then reduce to around 5 ML/day by closure.

Modelling of post-closure concentrations and loads of CoCs indicates possible low level migration of sulfate from the pit to the McArthur River in the medium to long term but predicted loads are expected to be less than 500 kg/day in the 100 years after closure, and declining to background in the longer term. Zinc at relatively low concentrations is expected to migrate from the ELS in the pit area in shallow alluvials over the long term, appearing to break through to the McArthur River diversion channel in 1000 years with loads in the order of 20-30 grams/day. At these levels, the influence of this source to contamination of the river is expected to be minor in comparison to background loads from the mineralised catchment (ERIAS Group, 2017).

Monitoring data collected for dewatering of the mine indicates a major hydraulic connection between the underground mine workings to the McArthur River. The location of this pathway has not been identified but is responsible for the majority of the mine dewatering effort. Reported dewatering rates from underground workings vary between 90 L/s and 200 L/s (IM, 2017). This connection has potentially significant ramifications for AMD migration into the river environment post-closure and into the long term if the water level in the pit rises above the water level in the river (ERIAS Group, 2018).

The Proponent has committed to investigating the recharge flow mechanisms of the underground void, and the hydraulic relationship between the pit and fault structures (draft EIS Chapter 8).

If hydraulic connectivity between the mined-out pit and the McArthur River is identified as a significant long-term risk to environmental values, the Proponent's Adaptive Management Plan may need to adopt alternative pit closure strategies. Decisions on closure strategies for the pit void should be based on advice from the independent panel of experts in accordance with Recommendation 23 and be acceptable to stakeholders and the broader community.

Pit lake water quality

At the conclusion of mining, the pit void will be a prominent feature in the McArthur River flood plain. A number of scenarios are being considered by the Proponent for managing the pit post-closure in an effort to limit the potential for impacts to the McArthur River after mine closure. These include maintenance of an isolated pit lake, and backflow or through-flow scenarios in which some McArthur River flows would be directed into the pit during annual flood events while the diversion is maintained as the primary flow channel.

Water quality in the pit after closure will be dictated initially by how groundwater inflows and poor quality water are managed during operations as part of the Proponent's operational mine planning and water management system.

Proposed in-pit disposal of reactive overburden and tailings, and the management of tailings consolidation water prior to closure, will have a significant effect on pit water quality in the early closure phase and potentially into the long-term. In-pit dumping of PAF(HC) and MS-NAF waste rock is proposed in the last seven years of mining with highly reactive materials co-disposed with tailings after completion of mining. Tailings would then be deposited into the pit over a 10 year period and the pit filled rapidly over a nominal period of 3 to 10 years.

Hydrogeochemical and pit lake water quality modelling were conducted for the EIS by KCB (Appendix VI of draft EIS Appendix T; Supplement Appendix M), considering the impact on pit water quality of dissolved loads from water inflows, direct loading from exposed open cut wall rock, as well as submerged loading by tailings, waste rock and wall rock, and time stepped to allow for progressive inundation of reactive materials over the proposed rapid filling period.

The NT EPA's independent expert reviewed the modelling and agreed that the modelling approach was appropriate and included suitably conservative assumptions such as no pit lake stratification and oxygen extending to 50 m below surface. Stratification was subsequently built into the model for the Supplement.

The modelling results indicate that near-neutral conditions are likely to persist due to alkalinity in tailings slurry and the availability of neutralising agents in the tailings and open cut walls. Bleed and consolidation water from the tailings as well as other inputs from pit walls and accumulated secondary minerals remobilised by excess water would result in poor initial water quality, but pit dewatering during tailings deposition would largely remove this contaminant mass. AMD generation from the pit walls would be significantly reduced by rapid filling the pit from the McArthur River and would largely cease when the pit is finally inundated. On the other hand, high water levels in the pit may cause outflows into the river.

Consolidating the tailings and non-benign waste rock towards the end of mining into one facility for complete inundation is, in current terms, the most secure, long-term management approach for these materials. However, the understanding of the long-term geochemical behaviour of the open cut relies solely on the KCB pit water quality modelling, which in turn relies on inputs from other models. Therefore, there are significant uncertainties associated with the hydrodynamics and geochemistry of the pit lake that need to be clarified during the mining operation.

Further investigation, monitoring and continual modelling review will be needed to determine the optimum closure strategy for the pit void. Proposed strategies will need to be reviewed by an independent panel of experts provided for in Recommendation 23 of this Report. The views of a range of stakeholders and the broader community will also need to be canvassed and taken into account.

The NT EPA considers that pit closure cannot occur for 20 years or more if the Proposal is authorised, and thus it is not necessary or appropriate to make a judgement on the best closure option in this Report. At present, all options for the pit lake proposed by the Proponent are too uncertain, particularly the back flow and flow through scenarios. If at some point in the future back flow and flow through scenarios are to be considered, then referral to the NT EPA will be required for an assessment decision.

5.1.4.2 Water management and monitoring

Water balance and management

The Proponent conducted water balance modelling to estimate the water management requirements for poor quality water from mine domains and to predict the potential impacts and risks of overflows from mine water storages as a result of the Proposal. The NT EPA's independent expert considered that the modelling provided appropriate information on the expected volumes and characteristics of various quality water to be managed in the MRM water management system under various climatic conditions during operations and post-closure.

The majority of the contaminant load is proposed to be stored in the TSF process water dam (PWD) when it is constructed (~2019). Prior to this, the NOEF PRODs are expected to store the bulk of contaminant load from increased NOEF toe seepage and pit dewatering. Poor quality water from PRODs, mine dams and the TSF PWD would be

recirculated through the mill, evaporated and treated. Permeate (good quality water) from proposed water treatment plants (WTP) would be reused on site or discharged to the environment, either directly or from the TSF water management dam in managed releases in accordance with WDL conditions.

The mass of contaminants in the TSF PWD is expected to increase steadily as mining progresses due to the gradual removal of the underground void water storage as mining progresses. Once in-pit tailings deposition commences, this water is used in the tailings reprocessing and is transferred to the open cut. In the interim, if the capacity of the TSF PWD and NOEF PRODs is exceeded, the Proponent has committed to storing excess water in the pit void to minimise the potential for uncontrolled discharges, which is likely to disrupt mining operations.

To limit this risk, the Proponent proposes to increase its managed release volumes to the McArthur River. The proposed WMS design facilitates release from the TSF water management dam at a maximum rate of 200 ML/d into Little Barney Creek while continuing managed releases from other release locations at a combined rate of 100 ML/day. Release volumes were calculated for the year 2023/24, stated in the EIS as the critical year. The model results indicate that for the critical year, managed releases would be required and there is a 50% annual exceedance probability (AEP) of releasing at least 3960 ML to the receiving waters and a 1% AEP of releasing at least 5800 ML to the receiving waters. The Proponent is currently authorised to release mine water from two locations.

The largest annual sulfate loads in mine water releases are predicted to occur early in the operational period during Stage 1 and Stage 2 (2018 to 2022) prior to the construction of the upgraded 15 ML/d WTP and Mill WTP and are expected to reduce significantly after this period.

The NT EPA understands that the 6 ML/day WTP (to be upgraded to 15 ML/day in the Proposal) has not yet been commissioned. It was proposed to be commissioned in January 2016 and then August/September 2017 (IM 2017). It would be of considerable concern to the NT EPA if operation of the WTP continued to be delayed. In such an event, the Proponent would need to provide alternative storage/evaporation/treatment options for poor quality water and implement interventions in accordance with its Adaptive Management Plan to be developed in accordance with Recommendation 28.

CoC concentrations at SW11 are generally predicted to remain below the trigger values during the operational period (if the WMS is fully functioning as proposed in the EIS) and during the closure period proposed by the Proponent (2047 to 3018).

In the long-term, sulfate concentrations are predicted to be elevated in Barney Creek diversion from NOEF seepage and potentially impacted groundwater in the old McArthur River channel is expected to increase from 20 ML/year to approximately 160 ML/year (on average) from 2100 to 2167 before stabilising at approximately 140 ML/year (on average) from 2200 onwards. CoC loads collected in the proposed sump are predicted to continue increasing and to stabilise in the long term (2500 to 3018), with sulfate loads at 3500 kg/day (Figure 13).

The proposed, long-term management solution for this seepage is to pump it to the hypolimnion in the pit lake with the expectation that stratification predicted by modelling, will trap poor quality water near the bottom. The NT EPA does not accept that the suggestion to pump contaminated water around the site for centuries is practical or sustainable and reiterates the need for improved source control and interception.

The NT EPA considers that further, more extensive investigation of closure options is essential, and this should be undertaken well before the end of mining as the process will take years. Proposed options will need to be reviewed by an independent panel of

experts provided for in Recommendation 23 of this Report. The views of a range of stakeholders and the broader community will also need to be taken into account.

Water quality monitoring

To ensure the NT EPA's overarching environmental outcome stated in Recommendation 3 of this Report will be met, the Proponent's water monitoring program must be appropriately designed. The following issues with the current monitoring program design are noted:

- Although there is an extensive water quality monitoring program, the current objective of water management is based on meeting trigger levels at one site (SW11) that is 2 km downstream from the mineral lease boundary and 4.5 km from the confluence of Barney Creek diversion and the old McArthur River channel.
- Monitoring of metals at SW11 at the time of managed releases occurs on a weekly basis only, and should be daily during days of discharge.
- The present focus is on CoC concentrations but the loads of lead and zinc must be the future focus.
- Monitoring focuses on filtered metals (bioavailable) but also needs to consider particulate-associated metals.
- Monitoring data collected by or for government agencies and the Proponent are not readily available to the community.
- There is little synthesis of the monitoring program data. Groundwater monitoring is not currently well integrated with surface water monitoring. A great volume of data is collected but is not used to achieve meaningful outcomes. The NT EPA considers that the monitoring program can be trimmed and re-focused with the main aim of establishing compliance with Recommendation 3. More efficient governance arrangements are recommended later in this assessment report.

Since the assessment of the Proposal commenced, a review of the waste water discharge regime and monitoring parameters has resulted in performance improvement requirements in the licence, including the need to:

- review the water quality compliance point to determine a suitable alternative or additional site/s to SW11
- revise the site specific trigger values in accordance with ANZECC (2000) Guidelines
- include mine-derived load estimates reporting to the McArthur River and possible inclusion of load-based trigger value/s
- revise the aquatic species protection level to ensure 95 – 99% of species are protected
- develop a strategic water management plan for the mineral lease.

The NT EPA supports the need to review the MRM waste discharge licence monitoring requirements, in accordance with Recommendations 13 and 27. In particular, the Proponent's singular focus on trigger value compliance at SW11 to determine whether the mine is impacting on environmental values in the McArthur River has been identified as an issue by the DENR water regulator and the DoEE, as well as the NT EPA.

The NT EPA considers that the groundwater and surface water monitoring programs must be reconciled and developed strategically to inform coordinated management of the Proposal so that performance targets and therefore the NT EPA's overarching

environmental outcome will be met. The monitoring program must be an integral part of the Proponent's Adaptive Management Plan so that management responses to exceedances of trigger criteria are likely to be timely and effective and occurs well before non-compliance.

Recommendation 13

Approvals and decisions in relation to the Proposal shall include conditions that require the Proponent to conduct a review and synthesis of all water monitoring programs (groundwater and surface water) and implement a revised program that is capable of identifying and quantifying impacts of mining activities and their trends on the environmental values and beneficial uses of the McArthur River to measure performance against the NT EPA's overarching environmental outcome in Recommendation 3.

The revised water monitoring program shall:

- i. quantify loads of lead and zinc entering the McArthur River each year**
- ii. quantify impacts to water quality and trends in groundwater and surface water at appropriate points including upstream and downstream of the mine to determine that objectives and targets are being met, including the effectiveness of source control to reduce loads as low as is reasonably practicable**
- iii. develop appropriate future trigger values for waterways on the mine site and the McArthur River in accordance with the ANZECC 2000 Guidelines. In the interim, the trigger values in the most current WDL shall be used.**

The review and revision of the water monitoring program shall be conducted to the satisfaction of the relevant regulator/s and the NT EPA as part of the broader monitoring review provided for in Recommendation 27 and incorporated into the authorised Adaptive Management Plan.

The results of the monitoring program are to be reported by the Proponent to the relevant regulator and audited by the Independent Monitor every three years. The monitoring report together with the Independent Monitor's audit report shall be made available to government agencies, the Community Reference Group and publicly on the Proponent's and relevant regulators' websites.

5.1.5 Conclusion against NT EPA objective

At present, based on all data available to the NT EPA, McArthur River water quality is good off the mineral leases. Aquatic life in the river appears to be unaffected by the mine to date and fish in the McArthur River are safe to eat (DoH, pers. comm. 2018). Poor quality water is contained within local waterways on the mining lease at present.

During future mining operations, the NT EPA considers that water quality impacts can be managed effectively with the Proponent's proposed water management system, provided that the WTP is successfully commissioned and operated, and water containment dams are sufficiently lined. This will not be without its challenges as the NT EPA expects to begin seeing recovery of waterways on the site early in post-closure, and sustained trends to recovery within 20 years following cessation of mining.

The NT EPA is concerned that any deterioration of the NOEF cover over time could lead to exposure of problematic materials, increased AMD and potentially significant impacts to the McArthur River. The NT EPA has made a number of recommendations in respect of the NOEF that, in its view, will improve the performance of the NOEF in the long term, and ensure that appropriate interventions are on standby to implement where performance target triggers are not being met. These include the requirement for

independent review of the NOEF design and environmental management performance by an independent panel (Recommendation 8).

The TSF is a major geochemical risk that if left unmanaged on the surface could lead to catastrophic effects to the McArthur River in the medium term. The NT EPA makes Recommendation 11 to ensure that the TSF design and seepage control system are independently checked and reviewed during operations.

The NT EPA considers that the tailings must be returned to the pit during closure for its environmental objective to be met and has made Recommendation 12 to support the Proponent's intention.

Following closure, there are high levels of uncertainty associated with the long term management of the mine pit. As a result, the NT EPA has decided to reserve any judgements on the merits of the Proponent's long term pit management/closure options.

Of some concern is the reliance on the geochemical properties of aquifers to attenuate metals and retard their migration in groundwater. While current conditions appear to indicate that this is effective in preventing significant metals contamination of local waterways and the off-lease receiving environment, metals breakthroughs may occur in the future, when the mine site may no longer be actively managed. The potential for mine-derived metals to become a significant contaminant source to the McArthur River in the medium to long term needs to be acknowledged and investigated. The NT EPA has made Recommendations 5 and 13 to improve certainty in this regard.

If the site is carefully managed to minimise groundwater and surface water contamination at its source and contaminated groundwater is intercepted before it can flow to waterways, there is a high likelihood that water quality impacts to the receiving environment from mine-derived inputs can be minimised and the NT EPA's overarching environmental outcome will be achieved.

The Adaptive Management Plan, to be developed in accordance with Recommendation 28 will be important for managing unexpected events and outcomes on this complex site. With the implementation of all the recommendations in this section of the Report, to meet the NT EPA's overarching environmental outcome, the NT EPA considers that the Proposal can be conducted in such a manner that its objective for inland water environmental quality is likely to be met.

5.2 Hydrological processes

5.2.1 Environmental objective

Maintain the hydrological regimes of groundwater and surface water so that environmental values are protected.

5.2.2 Environmental values

The environmental values associated with hydrological processes are the beneficial uses of the McArthur River and its catchment, as described for inland water environmental quality (Section 5.1.2).

Specific in-situ values supported by groundwater hydrological processes in the Proposal area and surrounds include:

- riparian vegetation and groundwater dependent ecosystems, both within creeks on the mining lease and along the McArthur River
- natural perennial waterholes regionally or associated with the McArthur River, that support aquatic ecosystems and may be culturally significant.

The implications of hydrological changes on aquatic ecosystems are addressed in Section 5.3. Djirrinmini waterhole is considered to be a particularly significant perennial waterhole and the cultural significance of this and other sites is assessed in Section 5.4.3.1.

5.2.3 Potential impacts

This section addresses the significance of hydrological changes caused by the existing mining activities and the reclassification of waste rock (the basis for the Proposal).

The Proposal has the potential to directly impact groundwater hydrological processes through:

- lowering of groundwater levels in waterholes and/or in areas associated with groundwater-dependant ecosystems and aquatic ecosystems due to drawdown from mine dewatering and mine water supply activities
- altered local groundwater flows (spatially, temporally and quantity) due to hydraulic loading of the NOEF, groundwater mounding and seepage interception measures
- a future isolated pit lake.

The Proposal has the potential to result in the following direct impacts on surface water hydrological processes:

- changes to natural drainage patterns from construction of stockpiles/OEFs and re-contouring land for proposed infrastructure
- changes to flow regimes of watercourses and associated processes of erosion and sediment deposition, within and adjacent to the Proposal, if rapid filling of the pit is adopted and/or due to the Proponent's proposed backflow and through-flow pit closure options.

5.2.4 NT EPA assessment

The NT EPA's overarching environmental outcome is to ensure the health of the McArthur River is protected along its whole length at all times from mine-related impacts. Managing activities to meet this outcome is likely to satisfy the NT EPA's environmental objective for hydrological processes.

5.2.4.1 Effect of groundwater drawdown on waterholes

Hydrogeological modelling undertaken to inform groundwater impacts from the Proposal indicates that mine pit dewatering and extraction from the water supply borefields during operations have the potential to reduce water levels in the Djirrinmini waterhole during the Dry season.

While the McArthur River is flowing, waterholes are full. For the months when river flow ceases, the EIS states that waterholes are groundwater-fed and rely on sufficient hydraulic head and inflows from groundwater systems to balance evaporation. Mine pit dewatering could lower hydraulic heads in local aquifers and thus reduce the contribution of baseflow from groundwater.

Drawdown at Djirrinmini waterhole was assessed in previous EIA processes with predictions of up to 0.5 m (2005 EIS and Phase 3 Supplement) and 0.7 m (Phase 3 draft EIS) for peak drawdown before river flows recommence. The groundwater impact assessment for the Proposal predicts up to 0.4 m of drawdown in the overburden and weathered bedrock, and up to 0.65 m of drawdown in the fresh bedrock adjacent to the waterhole. Post-mining, the bedrock aquifer is predicted to recover within ten years after the pit void is filled (draft EIS Appendix T). No measurements were presented to verify

these predictions and no data were available on the natural variation in water depth or duration of waterholes in the Dry season.

The potential impact to Djirrinmini is short term and periodic, occurring only during operations and early closure, and being most significant in the late Dry season. In order to fulfil the NT EPA's overarching environmental outcome of protecting the McArthur River from mine-derived impacts along its full length at all times, the magnitude of drawdown will need to be monitored in accordance with Recommendation 15 and appropriate intervention/s applied to maintain aquatic ecosystem values, particularly in very dry years (Section 5.3.4.2).

5.2.4.2 Pit lake scenarios

A number of scenarios have been proposed for the mine pit void at closure including an isolated pit lake (applicable for the early stage of all scenarios), backflow only (involving interaction between the pit and downstream reach of the McArthur River) and complete flow-through (pit interaction with upstream and downstream during 1 in 2 year flows). Total backfilling of the pit with mine wastes has also been suggested by some draft EIS submitters and is discussed in Section 7.2.4 of this Report.

A number of significant hydrological and geomorphological risks have been raised during the EIS process in regards to all pit closure scenarios, including:

- entrapment of sediments and wildlife with pit / river interaction
- changes to river morphology
- reduced freshwater flows in downstream reaches
- ongoing contamination of downstream water and sediments with pit / river interaction and groundwater leakage
- the possible requirement to engineer and maintain the mine levee wall and any inlet/outlet structures in perpetuity
- consequences of the original McArthur River channel becoming the primary flow path in the future.

It is not possible to accurately predict today, the most environmentally-sustainable solution for mine pit closure that will protect the McArthur River in the long-term, without further site-specific information.

Given that the mine pit closure options involve some major geochemical risks, the NT EPA considers that planning should be on the basis that closure options must not degrade the McArthur River or its values, consistent with the NT EPA's overarching environmental outcome of protecting the McArthur River from mine-derived impacts along its full length at all times.

The NT EPA has made Recommendation 5 in Section 5.1.4.1 of this Report to ensure that investigations to inform updated modelling and adaptive management continue, and appropriate interventions or alternative pit closure strategies can be implemented if groundwater hydraulic connection/s are identified as a significant, long-term risk to the McArthur River.

5.2.4.3 Mine levee wall and McArthur River diversion channel

Continuation of mining and the NT EPA's requirement to meet the overarching environmental outcome of protecting the McArthur River (Recommendation 3), will require the Proponent to ensure the function and integrity of the mine levee wall and the diversion channel is maintained during flood events until evidence is presented to support an alternative view.

The existing mine levee wall was designed to protect the mine and associated facilities from McArthur River flooding in a 0.2% (1 in 500) AEP flood with 1 m freeboard (Draft EIS Appendix U). Based on hydrological and hydraulic modelling to assess flood impacts on the mine site, the Proponent determined that no additional works for flood protection of the open pit would be necessary because the freeboard for the existing mine levee wall would be adequate to protect the open cut up to at least a 0.1% (1 in 1000) AEP flood event under the proposed OMP mining operations.

The NT EPA's independent expert estimates that, without maintenance, the levee would deteriorate and erode away in 1000 years, based on maximum predicted erosion rates for unweathered shale of 100 mm/year. When factoring in flood events the design life will likely reduce to around 500 – 750 years. This could be extended by ensuring that outer batter material is more erosion resistant. For example, if erosion resistance was improved such that erosion rates were reduced to 50 mm/year, time to failure would essentially double to around 1000 to 1500 years.

Over time climate change is expected to increase the severity of a 1 in 1000 AEP event. Data from the Australian Bureau of Meteorology shows that Wet season rainfall in the vicinity of the mine has been increasing by about 50 mm per decade on average based on the last 45 years of data. This suggests that climate change could further reduce the design life of the levee. The issue of higher rainfall and runoff is addressed in Appendix U of the draft EIS.

During mine operations, the levee embankment is subject to a program of ongoing routine surveillance and maintenance, which the Proponent proposes to extend beyond mine closure as part of overall MRM site management. The Proponent has also committed to ongoing maintenance and rehabilitation of the McArthur River diversion channel until closure objectives have been met. The NT EPA notes that the rehabilitation of the diversion channel is improving and the Proponent is encouraged to continue this program. The NT EPA considers that this matter will be a component of the periodic review by the independent panel, as provided for in Recommendation 23. Closure objectives will need to be agreed as part of the Mine Closure Plan, in consultation with stakeholders and the broader community, and the Community Reference Group, and subject to a 3 – 5 year rolling review by the independent panel.

5.2.5 Conclusion against NT EPA Objective

The NT EPA is of the view that the key hydrological process likely to be affected by the Proposal relates to the management of drawdown on waterholes near the mine. After closure, the impacts of the pit on groundwater recharge and baseflows to the McArthur River will be an issue to be managed.

With the implementation of NT EPA recommendations in this Report, the NT EPA considers that impacts can be prevented, mitigated or managed during the operations period and early closure. Based on current information, the NT EPA does not have a preferred closure option. The NT EPA's view is that options for mine closure must be developed to meet the NT EPA's overarching environmental outcome of protecting the McArthur River from mine-derived impacts along its full length at all times and in accordance with International Council on Mining and Metals (ICMM) Guidelines or other leading practice approaches to mine closure and relinquishment.

The NT EPA considers that, with the implementation of relevant recommendations from this Report during operations and in the short to medium term after closure to meet the NT EPA's overarching environmental outcome, the Proposal could be conducted in a manner that the NT EPA's environmental objective for hydrological processes is likely to be met.

5.3 Aquatic ecosystems

5.3.1 Aquatic ecosystems objective

Protect aquatic ecosystems to maintain the biological diversity of flora and fauna and the ecological functions they perform.

5.3.2 Environmental values

The freshwater reaches of the McArthur River extend upstream from Borroloola. Between Borroloola and Top Crossing (50 km upstream from the Proposal), the McArthur River has a well-defined channel with few major tributaries. In the Dry season, the river contracts into a series of pools, separated by stretches of dry, sandy river bed. Some of the pools are maintained year-round by groundwater inflows.

Surprise Creek, Emu Creek and Barney Creek flow into the McArthur River within the MRM leases. These creeks are mostly ephemeral with small spring-fed pools usually maintained year round in the upper reaches of Emu Creek and Surprise Creek, and connect to the McArthur River only during flows in the Wet season.

Depending on the location and the time of year, the aquatic habitats within the McArthur River and its tributaries include riffle zones, waterholes (some up to 6 m deep) and extensive areas of submerged woody debris. The varying habitats support macroinvertebrate communities.

Five species of aquatic reptiles have been recorded within freshwater sections of the McArthur River. Three of these, the Arafura file snake (*Acrochordus arafurae*), Worrell's short-necked turtle (*Emydura subglobosa worrelli*) and freshwater crocodile (*Crocodylus johnstoni*) are regularly recorded in the McArthur River in the vicinity of the mine. The estuarine crocodile (*Crocodylus porosus*) is an occasional visitor to the MRM leases and the northern snake-necked turtle (*Chelodina oblonga*) is a scarce resident.

A total of 47 species of fish have been recorded from freshwaters of the McArthur River above the Burketown Crossing (in Borroloola). Twenty-eight of these are considered to be freshwater species (capable of breeding in freshwater), while the remaining 19 species are estuarine vagrants.

Of the estuarine vagrants recorded within freshwater reaches, the bull shark (*Carcharhinus leucas*) and largemouth sawfish (*Pristis pristis*) are regularly found in the McArthur River as far upstream as Eight Mile Waterhole. The sawfish is of particular interest in respect of the Proposal due to its lifecycle and habitat requirements, and its status as a protected species under the *Fisheries Act* and the *Territory Parks and Wildlife Conservation Act*. It is also considered a MNES under the EPBC Act, which is discussed further in this section and in more detail in Section 6.1 of this Report.

5.3.3 Potential impacts

The key potential impacts to aquatic ecosystems that could affect the NT EPA's objectives are considered to be:

- impacts on water quality and biota from contaminated groundwater, dust and/or runoff in the Dry season
- impacts to habitat extent and habitability due to draw-down of water tables and shrinkage of Dry season pools
- impacts to water quality, habitats and connectivity due to erosion and sedimentation or failure of earthen infrastructure (e.g. mine levee wall)
- stranding of fauna in the pit lake if the lake is connected to the McArthur River in a future closure scenario.

5.3.4 NT EPA assessment

5.3.4.1 Contamination of aquatic habitat

The NT EPA's overarching environmental outcome is to ensure the health of the McArthur River is protected along its whole length at all times from mine-related impacts. Managing activities to meet this overarching environmental outcome is likely to satisfy the NT EPA's environmental objective for aquatic ecosystems.

Water quality and environmental monitoring has found no evidence of contamination of aquatic biota in the McArthur River near the mine site or downstream as a result of mining activities (IM, 2016 & 2017). Impacts to aquatic biota as a result of MRM operations are therefore largely restricted to waterways within the mine site.

The Proponent's current monitoring indicates that biota within the reaches of Surprise Creek and Barney Creek diversion on the mine site occasionally have elevated concentrations of lead, zinc, and other metals, and macroinvertebrate assemblages are beginning to show impact in these sites compared with reference sites (MRM, 2017a). However, an analysis of trends has not been presented and there is some uncertainty about the actual degree of impact.

The ongoing groundwater contamination by CoCs in baseflow in creeks on the site is a long-term risk. Elevated concentrations of zinc (30 µg/L) in baseflow are predicted to be just under the 80% species protection level (i.e. 80% of species will be protected at 31 µg/L (ANZECC, 2000)) for many years. At present, migration of metals appears to be limited in extent due to the nature of the hydrogeology on site (Section 5.1.4.1) but this situation may alter as the NOEF expands. Recommendation 5 provides for continued groundwater flow and quality monitoring to provide data on which informed management decisions can be made in advance of significantly adverse impacts occurring.

Trigger levels for a wide range of parameters are listed in the current WDL and these are considered by the NT EPA to provide a reasonable level of protection to aquatic organisms. The Proponent provided a forward works program for developing site-specific trigger values for CoCs in the context of aquatic ecosystem protection (Supplement Appendix W). While not specific to ecotoxicology, the proposed program does mention the potential inclusion of selected single-species toxicological tests using multiple lines of evidence approaches, and direct toxicity assessment with consideration of whole effluent testing, taking into account bioaccumulation and biomagnification in food webs, including bush tucker use. This program will inform the monitoring programs in Recommendations 13 and 15, and the overall synthesised monitoring as provided for in Recommendation 27 of this Report.

The EPA considers that further ecotoxicological testing may be appropriate for any contaminants for which the factor of safety is small in relation to the WDL triggers, and potentially to provide a basis to refine the annual load limits for lead and zinc over the next decade.

Recommendation 14

Approvals and decisions in relation to the Proposal shall include conditions that require the Proponent to prepare and implement a research and investigation program designed to determine the chronic and acute impacts to biota of mine-derived contaminants using recognised and accepted ecotoxicological testing. The program shall be designed to integrate with the monitoring program to be developed in accordance with Recommendation 15. Results of the program shall be used to inform trigger criteria in the Adaptive Management Plan.

The program shall be prepared and implemented to the satisfaction of the Department of Environment and Natural Resources, and the Australian Government Department of the Environment and Energy.

As discussed in Section 5.1.4 of this Report, Barney Creek and Surprise Creek are already impacted by contaminated seepage. These creeks are not considered critical habitat for aquatic species on a population scale. Emu Creek to the north of the NOEF has the potential to become contaminated as the NOEF expands to its full extent.

The NT EPA considers that managing contaminant sources and intercepting contaminated groundwater before it expresses to waterways will be critical in preventing impacts on aquatic habitats in the McArthur River (Section 5.1.4.1 of this Report). The NT EPA's overarching environmental outcome of protecting the McArthur River from mine-derived impacts along its full length at all times and ensuring that loads of contaminants entering the McArthur River do not increase above current loads, and Recommendation 4 ensuring that creeks on the site show improving trends in water quality, are expected to provide sufficient protection for aquatic ecosystems.

5.3.4.2 Groundwater drawdown of refuge pools

Djirrinmini Waterhole is one of several known permanent waterholes upstream of the mine that provide Dry season habitat (refugia) for freshwater sawfish and other aquatic species. As discussed in Section 5.2.4.1 of this Report, water levels in Djirrinmini are predicted to decline by up to 0.7 m in the late Dry season as a result of dewatering of the mine pit, although this is yet to be demonstrated by any measurements. There are several pools in the McArthur River diversion channel that sawfish successfully inhabit in the Dry season. These pools are part of the McArthur River and should be protected.

The surface area of Djirrinmini Waterhole is estimated to be approximately 30 000 m² which appears to be the largest pool within a ~30 km reach of the McArthur River upstream and downstream of the mine site (draft EIS Appendix 2 of Appendix W; Supplement Section 7.13). The EIS states that the majority of Djirrinmini Waterhole would have water depths of between one and two metres in the late Dry season, and therefore a drawdown of up to 0.7 m has the potential to have a large effect on available habitat for aquatic species including listed threatened species (Appendix W).

No baseline morphological assessment of aquatic refuges in nearby sections of the McArthur River in the late Dry season was available for review to form a basis for assessment of effects from predicted drawdown. The NT EPA notes that such a survey is recommended in the Aquatic Ecology Impact Assessment for the Proposal (EIS Appendix W, Section 5.3.2). The NT EPA is of the view that such an assessment is necessary to identify key refuges and provide a basis for decision making in accordance with the Adaptive Management Plan should impacts from continued mining activities occur. Recommendation 15 of this Report makes provision for characterisation of Dry season aquatic habitat near the mine to achieve this.

During operation, the Proponent proposes to augment flows to refuge pools adjacent to the mine site such as Djirrinmini in the event that water levels are found to be significantly lower than natural seasonal variation in water levels. The Proponent indicates that suitable water sources for short term artificial recharge will be determined. Any clean and sustainable supplementary flow sources will need to be identified early to be included as interventions in the Adaptive Management Plan and should be approved by the relevant regulator/s.

Appendix W of the draft EIS recommends that translocation of large listed aquatic fauna to larger pools in the McArthur River should be considered if any are found to be trapped in Dry season refuges affected by drawdown. The NT EPA considers that such measures would be an indication that the Proponent's proposed interventions have failed and should be treated as a last resort.

5.3.4.3 Impacts of rapid filling the pit void

As discussed in Section 5.1.4.1 of this Report, the Proponent proposes to fill the pit void to improve water quality outcomes for the isolated pit when in-pit tailings deposition is completed. Taking into account the NT EPA's overarching environmental outcome of protecting the McArthur River from mine-derived impacts along its full length at all times, conditions for any extraction of flood water must consider aquatic ecosystem protection in the McArthur River.

Recruitment of many species of fish, including the largemouth sawfish, is positively correlated with the size and extent of Wet season flows. Thus reduction in flows due to proportionally high extraction rates, particularly in poor Wet seasons, has the potential to impact on river ecology. Reduced recruitment of aquatic species in low flow years has been attributed to reduced habitat availability and connectivity, lack of flow-related spawning cues and potential reductions in availability of food (draft EIS Appendix W). While these are generally understood ecological principles, there is currently insufficient understanding of specific flow requirements to sustain aquatic ecosystems within natural levels of variability in the freshwater reaches downstream of the mine to appropriately condition allowable extraction rates and volumes.

At a minimum, the NT EPA expects that a sound understanding of aquatic ecosystems in the McArthur River and flows required to sustain them, will be needed to demonstrate sustainable water extraction rates under any future extraction licence.

The NT EPA requested that the Proponent assess the impacts to aquatic ecology of the isolated pit lake scenario, and specifically to:

- model groundwater and surface water flows and associated contaminant loads from the isolated pit lake into the McArthur River
- outline strategies, based on those models, to capture seepage and flows into the McArthur River to minimise impacts from contaminants in the pit lake
- assess the residual ecological impacts of elevated contaminants in McArthur River with control strategies in place, and the extent of the impacts
- determine the potential for contaminants to accumulate in aquatic fauna
- determine the adequacy of current surface water, groundwater and aquatic biota monitoring programs to assess the level of contamination from the isolated lake.

The Proponent provided an isolated mine pit lake water quality assessment in the Supplement, which indicated that without active management, water quality would progressively deteriorate due to evapo-concentration, and eventually result in a highly saline mine pit lake. The cumulative effect of the excess evaporation is predicted to result in the mine pit lake surface stabilising below the pit crest level (~100 m freeboard, 350 years after closure) and regional groundwater levels and the pit would act as a local groundwater sink. In the event of extreme floods, the freeboard would allow sufficient storage volume in the mine pit lake to accommodate inflows such that the risk of direct outflow from the mine pit lake to the McArthur River would be minimal (Supplement Appendix M).

The Proponent conducted waterways model sensitivity testing, including modelling of an isolated mine pit lake scenario (Supplement Appendix N). The potential impacts on McArthur River water quality of an "extreme event" (a 1 in 1000 year flood) resulting in an overflow of the mine levee wall and water discharge from the isolated mine pit lake to the McArthur River were assessed. Results indicate initial elevated concentrations of CoCs (above SW11 trigger values) for a short period of time (up to two days) before continual dilution by river water reduces these CoC concentrations to below SW11

trigger values for the remainder of the flood event and any subsequent flood events in the following weeks or months.

The risks of contaminants accumulating in downstream aquatic fauna as a result of the isolated pit lake overflow during extreme flood events (>1% AEP or levee failure) appears to be very small, as in these circumstances, the model indicates exposure to elevated CoC concentrations would be for short durations. The fate and effects of CoC loads including particulate-associated metals was not assessed.

The Proponent has committed to developing detailed surface water, groundwater and aquatic biota monitoring programs in consultation with the regulator prior to the establishment of the isolated mine pit lake (Supplement Appendix J), should this be the preferred final closure option. The NT EPA considers that monitoring programs will need to be rationalised and synthesised and modelling updated in consultation with the independent panel/s, and incorporated into the Adaptive Management Plan to be developed in accordance with Recommendation 28 of this Report. Updated monitoring programs and modelling will also be used to inform decisions on closure strategies for the pit void.

Recommendation 15

Approvals and decisions in relation to the Proposal shall include conditions that require the Proponent to implement an aquatic ecosystem monitoring program based on improved understanding of aquatic ecosystems in the McArthur River including flow requirements and available Dry season habitat. The program shall be designed to assess impacts from the mine on:

- i. water levels in refuge pools/waterholes, upstream and downstream of the mine, including in the McArthur River diversion channel**
- ii. water quality in refuge pools/waterholes in the Dry season**
- iii. the health of aquatic biota in the McArthur River using non-lethal sampling methods.**

The monitoring program shall be prepared and implemented to the satisfaction of the Department of Environment and Natural Resources, and the Australian Government Department of the Environment and Energy.

The monitoring program shall be designed to integrate with a revised monitoring program provided for in Recommendation 27 and incorporated into the Adaptive Management Plan, to be developed in accordance with Recommendation 28

The results of the monitoring program are to be reported by the Proponent and audited by the Independent Monitor every three years. The monitoring report together with the Independent Monitor's audit report shall be made available to government agencies and the community on the Proponent's and relevant regulators' websites.

5.3.5 Conclusion against NT EPA objective

The NT EPA's objective for aquatic ecosystems is to protect aquatic ecosystems to maintain the biological diversity of flora and fauna and the ecological functions they perform. To meet this objective, the NT EPA requires the overarching environmental outcome of protecting the McArthur River from mine-derived impacts along its full length at all times to be met and that contaminant loads discharged to the river from the mine site must be contained such that there is no future increase above current loads. The monitoring data available to the NT EPA indicate that this outcome is being met at present. Revegetation and rehabilitation of the McArthur River diversion channel and

riparian zone is improving and will play an important role in restoring ecological function to this section of the river.

Nonetheless, there is ongoing community concern about the existing and potential impacts to the McArthur River which, in the view of the NT EPA, largely results from inadequate analysis and publication of monitoring results by the Proponent and government agencies. The NT EPA recommends that future monitoring programs need to be focussed on specific issues, with the data collated, peer reviewed and published. The NT EPA considers there is no value in carrying out monitoring programs in which the data are not validated, summarised, published and used to inform decisions or to inform the community. Monitoring programs that cannot meet this requirement should be discontinued and replaced by more useful programs.

The NT EPA considers that, with the implementation of the recommendations above to meet the NT EPA's overarching environmental outcome, the Proposal could be conducted in a manner that its objective for aquatic ecosystems is likely to be met.

5.4 Social, economic and cultural surroundings

5.4.1 NT EPA objective

Protect the rich social, economic, cultural and heritage values of the Northern Territory.

5.4.2 Environmental values

5.4.2.1 Cultural and heritage values

The cultural values of the MRM site and the Gulf region are strongly tied with Aboriginal traditional values. The area around the MRM site has particular cultural importance, with complex custodianship that is a result of the historical cultural significance of the area for various language groups (as described by AAPA in its response to the Supplement). Sacred sites on the MRM lease are protected under both the *Aboriginal Land Rights Act (Northern Territory) Act 1976* (ALR Act) and NTASS Act; in addition, places and objects that have been modified in the course of past occupation by Aboriginal people are protected under the *Heritage Act*.

There are around 22 sacred sites within the mining lease area that are registered or recorded in accordance with the NTASS Act. These sites of cultural significance typically comprise waterholes, trees and hills and '*have either a direct link to dreamtime stories or are important to the history and culture of the local Aboriginal people*' (draft EIS p. 12-16). MRM has 24 Certificates, issued by AAPA, that are intended to protect sacred sites by specifying operating conditions in the area³ (draft EIS Table 11-4). Several places that have been modified in the course of past occupation by Aboriginal people are located within the MRM site and in the vicinity of MRM. These places are protected under provisions of the *Heritage Act*. One such place (MRM4), is a large stone-quarry which also contains traditionally manufactured objects which are also protected under the *Heritage Act*. In addition to its value to the wider community as an archaeological place, this site has value to local Aboriginal people. The size and concentration of artefacts at the site indicate that it was an important location for the procurement of raw stone material and the manufacturing of stone tools (draft EIS section 11.3). Previous applications by the Proponent to destroy MRM4 have been refused, and objects located within MRM4 have been required to be retained in-situ.

³ <https://www.aapant.org.au/our-services/authority-certificates>

5.4.2.2 Socio-economic values

The Gulf region⁴ has a human population of around 4800 people and 85% of these people are Aboriginal (ABS, 2017a). The largest town in the region is Borroloola, 65 km by road from MRM and located on the McArthur River downstream of MRM, with a population of around 900 people. Borroloola provides services for other population centres, pastoral properties, tourists, and 26 Aboriginal camps/outstations located within the region (draft EIS section 12.2.1). The four main Aboriginal language groups in Borroloola, and whose country comprises the Gulf region, are the Yanyuwa, Garawa, Mara and Gurdanji (draft EIS p 12-5). The Gurdanji and Yanyuwa people traditionally used lands at MRM, while Garawa, Mara and other Aboriginal language groups have interests in the Gulf region (draft EIS section 11.1).

The Proponent recognises that people in the region place strong value on the natural environment (e.g. draft EIS Appendix Y section 6). The importance of the area for Aboriginal people was articulated in the NLC's and EDO's submissions on the draft EIS (pp. 5, 6 and p. 2 respectively). People other than the local Aboriginal people also place strong value on the natural river resources, demonstrated by high visitation to the area for fishing in the McArthur River (for example, over 1000 people annually reside at the King Ash Bay fishing centre (draft EIS section 12.2.1.3)). This demonstrates that the natural environment has a strong social value in the region.

The Gulf region is a remote area with a different economic profile to the majority of the NT. In general, people in the region have lower incomes and less opportunities for employment than most Territorians. Median personal income in the Gulf region and in the Borroloola local area is considerably lower (62% and 48% lower, respectively) than the NT as a whole (draft EIS, p. 12-17). Employment statistics from the 2011 census indicate that 41% and 47% respectively of the Borroloola and Gulf region population aged 15 and over were employed (draft EIS Appendix Z tables 5 and 10), which is less than half the employment rate of the NT as a whole.

Beyond the Gulf region, economic stakeholders in MRM operations include Glencore, employees from around Australia, contractors and suppliers, the Australian Government, and the Northern Territory Government.

5.4.3 Potential impacts

5.4.3.1 Cultural and heritage impacts

The following impacts to cultural surroundings may occur as a result of implementation of the Proposal:

- biophysical impacts to sacred sites that are not addressed under existing AAPA authority certificates
- degradation of the significant cultural values of archaeological site MRM4
- biophysical impacts to land and water, at the MRM site and downstream from it, that would degrade cultural values.

5.4.3.2 Socio-economic impacts

The following impacts to socio-economic surroundings may occur as a result of implementation of the Proposal:

⁴ Gulf Statistical Area as defined by the Australian Bureau of Statistics

- significant positive and negative social impacts during mining, following closure and post-mining, that may affect:
 - community cohesion and stability
 - shared beliefs, customs, values and language
 - community engagement and participation
 - access to and control over environmental resources
 - physical, mental, social and spiritual health and wellbeing
 - lifestyle
 - aspirations and fears about the future of the community
 - community safety
- continued positive economic benefits at the local, Territory and National scale
- negative economic impacts following mine closure.

5.4.4 NT EPA assessment

5.4.4.1 Cultural and heritage

The NT EPA recognises that the Proposal may cause damage to or interference with culturally significant places, including sacred sites on or in the vicinity of the proposed works. The NT EPA is of the opinion that risks to such culturally significant places are best managed by other statutory authorities, namely the AAPA and the Northern Territory Heritage Council (supported by the Heritage Branch of the Department of Tourism and Culture), through the established processes set out in the NTASS Act and *Heritage Act* respectively. In this section, the NT EPA considers the potential impacts on cultural aspects of the environment that may occur from implementation of the Proposal. These cultural aspects include several sacred sites and the Aboriginal archaeological place known as traditional stone-quarry MRM4.

Sacred sites

The Proponent has advised that some of the existing AAPA authority certificates will need to be amended to enable the Proposal to proceed (draft EIS table 11-4). Any biophysical impact to a sacred site could be considered to impact on cultural values. The acceptability of any impacts on sacred sites is a matter for determination by those with authority to consent under the NTASS Act.

6465-22 Damangani (Mt Stubbs / Barramundi Dreaming)

Damangani, also known as Mt Stubbs or Barramundi Dreaming, is visually prominent in the region, and located adjacent to the NOEF. This natural feature is about 80 m high and 1.6 km long. The NOEF approved for the Phase 3 expansion involved the storage of 530 Mt of waste rock and cover material within a footprint of 485 ha and to a height of 80 m. An existing Authority Certificate provides for the height of the NOEF to 80 m in respect of this sacred site. The 80 m height was determined so that the NOEF would be no higher than the ridge of Damangani (Phase 3 EIS p. ES-9). The Proposal would increase the height of the NOEF to 140 m to store 595 Mt of waste rock and cover material within a 511 ha footprint.

The NT EPA viewed a 3D model that the Proponent used to communicate the proposed landform to community members during consultation meetings, in recognition that the proposed higher NOEF could alter the visual prominence of Damangani in the area.

The Proponent has recognised that this increase in height of the NOEF may be considered an impact on the cultural value of Damangani (Supplement section 7.8). The

NT EPA has not made a judgement on the cultural impact of the increase in height of the NOEF, as that is a matter for the appropriate custodians of the site and the AAPA. The Proponent advised it has applied for a variation to an existing authority certificate (draft EIS section 3.4.4.3.5.5.1; Supplement section 7.8) to cover these new works. NT EPA understands from the AAPA that this matter is still under consideration.

The NT EPA considers that the increased height of the proposed NOEF allows for the storage of larger volumes of problematic material while restricting the footprint extent. While the steeper slopes increase the risk of erosion of the NOEF batters and potential sedimentation on the boundary of Damangani, the NT EPA is of the view that the relatively reduced NOEF footprint and improved design for waste rock disposal will have benefits in the longer term for protecting the health of the McArthur River.

Additionally, the NT EPA has made Recommendation 9 to manage seepage at the eastern side of the NOEF domain, which could increase the risk of encroachment of NOEF seepage controls on the restricted works area associated with the protection of Damangani. The NT EPA is of the opinion that the mitigation measures identified in Recommendation 9 are essential to meet the NT EPA's overarching environmental outcome of protecting the health of the McArthur River, which also has cultural values. The NT EPA notes that there may be some flexibility in the design that allows for modifications that result in small changes in the footprint extent to reduce encroachment of the NOEF on culturally sensitive areas, providing that any modification does not diminish the capacity to meet all of the NT EPA's environmental objectives. The acceptability of the residual potential biophysical impact to Damangani is a matter for determination by those with authority to consent under the NTASS Act.

Overall, the NT EPA considers that the proposed NOEF would have less potential biophysical impacts than an alternative NOEF design with a lower height but larger surface footprint. However, the NT EPA acknowledges that this could result in impacts to cultural values of Damangani as a result of the additional height, as identified above.

If a resolution of the potential cultural impacts of the Proposal on Damangani is reached in accordance with the requirements of the NTASS Act, the NT EPA's environmental objective for social, economic and cultural surroundings would be met in relation to Damangani. If a resolution on the potential cultural impacts requires a significant modification of the Proposal, the Proponent would be required to notify the NT EPA of the changes in accordance with Recommendation 2 of this Report. The NT EPA notes that any negotiation should include consideration of the potential impacts to the McArthur River and may necessitate consultation with custodians of downstream sacred sites.

6165-5 Djirrinmini and 6165-25 Wurrini

Djirrinmini waterhole is sustained by shallow and deep groundwater. The Proponent's modelling indicates that the Proposal would impact Djirrinmini by lowering the water level by up to 0.7 m due primarily to mine pit dewatering during operations. The NT EPA considers that this could reduce the ecological values of Djirrinmini, especially during the late Dry season throughout the operation of the Proposal, as discussed in Sections 5.2.4.1 and 5.3.4.2. Wurrini is a waterhole upstream of Djirrinmini, and is also considered to potentially be in the zone of influence of pit dewatering and therefore could have reduced water levels in the late Dry season with potential impacts on ecological values. The predicted drawdown at Wurrini has not been reported by the Proponent.

The NT EPA's overarching environmental outcome of protecting the McArthur River from mine-related impacts along its full length at all times provides an important safeguard for Wurrini and Djirrinmini. It places the onus on the Proponent to ensure the magnitude of drawdown and quality of groundwater is adequately monitored and appropriate intervention/s are applied to maintain aquatic ecosystem values, particularly in very dry

years. Such interventions will need to be an integral part of the Proponent's Adaptive Management Plan. This is discussed in further detail in Section 7.4 of this Report.

6165-101 Donagan's Lagoon

Donagan's Lagoon, located near the McArthur River downstream from the mine site, could be impacted by any water contamination flowing downstream from the site during high-water conditions; this could arise from surface or groundwater from any of the mine domains (TSF, NOEF or open pit). The NT EPA's overarching environmental outcome of protecting the McArthur River from mine-related impacts along its full length at all times provides an important safeguard for Donagan's Lagoon. It places the onus on the Proponent to ensure the waters of McArthur River do not become contaminated.

6165-64 Nanbadini

Nanbadini, a waterhole located north-east of the TSF, is considered by the NT EPA to potentially be within the zone of influence of AMD seepage controls at Surprise Creek. The implementation of these controls presents an undefined risk of groundwater drawdown at Nanbadini. The NT EPA is of the opinion that the mitigation measures proposed by the Proponent at the TSF are essential to meet its environmental objective for inland water environmental quality.

Other sacred sites

A number of other sacred sites within and near MRM also have the potential to be impacted as a result of potential water contamination and groundwater drawdown. These include single mature trees (6165-65 Garbula, 6465-8 Coolibah, 6165-7 Coolibah 2) and a rocky area known as Stinking Turtle (6165-6 Yukuwala). Garbula in particular is susceptible to impact, as it is well within the groundwater drawdown cone and potentially dependent on groundwater for survival.

Recommendation 16

Approvals or decisions in relation to the Proposal, shall include conditions that require the Proponent to conduct all works in accordance with a valid Certificate issued in accordance with the *Northern Territory Aboriginal Sacred Sites Act*.

Archaeological place MRM4

The proposed footprint of the NOEF completely overlies the location of large stone-quarry which also contains traditionally manufactured objects which are also protected under the *Heritage Act* as an 'archaeological place' containing many 'archaeological objects' MRM4 (see section 5.4.2.1). The current Proposal includes relocating the 'archaeological objects' from MRM4 to within the boundary of another 'archaeological place', MRM3, prior to extending the NOEF over the location of MRM4. Under the *Heritage Act*, Ministerial approval is required to interfere with any 'archaeological place' or 'archaeological object'.

The Department of Tourism and Culture (Heritage Branch) has recommended that MRM4 not be subjected to any further disturbance if at all possible, and further advised that it does not support the relocation of artefacts to within the boundary of another archaeological place. The NT EPA notes that the significance of MRM4 has long been recognised and as recently as 2005 and it was afforded continued protection. The NT EPA therefore considers that the relocation of artefacts from MRM4 to the site of MRM3 would diminish the cultural values of both sites.

The Proponent has applied for permission to disturb this site under the *Heritage Act*. This will be a matter for approval by the Minister for Tourism and Culture. The NT EPA considers that the Proponent should obtain the views of Aboriginal people who may

have an interest in this site and present that information to the Minister to assist in the making of a decision regarding the site.

The NT EPA is of the view that the Proponent has not sufficiently considered alternative designs of the NOEF that would avoid disturbing MRM4, or presented sufficient justification for the proposed option to disturb MRM4. Destruction of this site should be avoided if possible, and every effort should be made to protect the integrity of MRM3, and the archaeological record of MRM4. A redesign of the NOEF could avoid impacts to MRM4.

As discussed previously, the NT EPA believes there may be some flexibility in regards to the height and extent of the footprint to reduce encroachment of the NOEF on culturally sensitive areas including MRM4. The NT EPA considers that a modification of the NOEF design that results in a small change in the footprint extent, while still meeting all its environmental objectives, would be acceptable. The NT EPA recognises that further negotiations may be required to resolve cultural concerns with the proposed NOEF design and is willing to be part of any such negotiations on NOEF design for cultural reasons, to further explain environmental issues.

Recommendation 17

Prior to any approvals for the Proposal, the Proponent and the responsible Minister shall consult with the Minister for Tourism and Culture on an alternative design of the NOEF that would preserve archaeological site MRM4. Any alternative design of the NOEF must achieve the same environmental outcomes as the currently proposed NOEF, taking into consideration the recommendations in this report.

Custodians and traditional owners

The Proponent has reported on its extensive consultation with stakeholders, including custodians of sacred sites and traditional owners of lands (Supplement Appendix Q). The NT EPA acknowledges this consultation and frequent engagement with people from the language groups who have a cultural interest in areas that may be affected by the Proposal.

As discussed in sections 1.3.2, 3.1 and 5.4.2.2 of this Report, some stakeholders have expressed mistrust in the Proponent due to perceptions of poor engagement and concerns that it has not consulted with the correct people. The NT EPA considers that identification of the appropriate people is essential as custodians have a legal role in the protection of sacred sites under the NTASS Act. The NT EPA understands that the legal native title interest of traditional owners has effectively been suspended over land within the MRM leases until 2043⁵ and that native title interests will revive at that time. The NT EPA considers that the views of those with traditional interests in lands that may be permanently impacted by the Proposal should be taken into account in decisions about avoiding damage to cultural values.

Additionally, the NT EPA is of the view that custodians and traditional owners should be fully informed about the potential impacts of the Proposal identified in this report. The NT EPA notes the Proponent's statement that some custodians and/or traditional owners have expressed their agreement with aspects of the Proposal prior to the finalisation of the NT EPA's assessment. The NT EPA makes no judgement on whether people

⁵ see the McArthur River Project Agreement Ratification Act

entering these agreements were sufficiently informed or whether they received independent advice, and considers this a matter for AAPA to determine.

The NT EPA considers that the Proponent should ensure that they have undertaken a thorough process to identify and engage with the appropriate people, and communicate this process to the public as a way of increasing community trust. The NT EPA notes that there are formal avenues available that may assist the Proponent identify and engage with the correct custodians and traditional owners. For example, the NLC (as the native title representative body covering the area and as a function under the ALR Act) is required to 'assist Aboriginals in the taking of measures likely to assist in the protection of sacred sites on land (whether or not Aboriginal land)⁶ and ascertain and express the wishes and the opinion of, and protect the interests of, Aboriginals in relation to Aboriginal land'⁷. The NT EPA notes that under the NTASS Act, the AAPA must be 'satisfied' that any agreement, underpinning the issue of an Authority Certificate, must be made with the custodians of any sacred sites on or in the vicinity of the proposed works.

Recommendation 18

Approvals or decisions in relation to the Proposal, shall include conditions that require the Proponent to demonstrate to the responsible Minister, and the AAPA or the Minister for Tourism and Culture (where relevant), that it has undertaken a thorough process to identify, inform and consult with the appropriate custodians and traditional owners with an interest in lands that would be or may be affected by the Proposal.

Summary – Cultural and heritage

The NT EPA has considered and described the potential impacts on sacred sites and an archaeological site that may occur from implementation of the Proposal. This information is intended to inform those with roles in making decisions regarding these cultural aspects of the environment. These decisions will be made in accordance with legislative processes. To ensure the cultural values of sacred sites are protected, the NT EPA has recommended that the Proposal is to be implemented in accordance with a valid Certificate issued in accordance with the NTASS Act. The NT EPA has recommended that the Proponent consider alternative designs of the NOEF that would protect archaeological site MRM4 from interference.

The NT EPA recognises the rights and interests of Aboriginal people as custodians of sacred sites and as traditional owners of the land. The NT EPA recognises the legislative process available to custodians and traditional owners to protect and maintain the value of cultural heritage. The NT EPA has also recommended that the Proponent be required to demonstrate it has undertaken a thorough process to identify and consult with appropriate custodians and traditional owners regarding potential impacts to cultural values. If cultural considerations, negotiations, or the outcomes of statutory processes result in the need to make a significant modification to the Proposal or change any of the measures recommended by the NT EPA in this Report, the Proponent may have an obligation to refer the changes to the NT EPA in accordance with Recommendation 2 of this Report.

⁶ ALR (NT) Act 1976 Part III 23(1)(ba)

⁷ ALR (NT) Act 1976 Part III 23(1)(a)&(b); this is applicable because ~40km of the McArthur River downstream of MRM flows through Aboriginal land and may be affected by the Proposal

5.4.4.2 Socio-economic

People in the local community, including custodians and traditional owners, have the greatest long-term interest in the Proposal and its impacts. The Proponent envisages that some of these people would be involved in managing and monitoring the MRM site during the post-closure stage until the year 3017. The NT EPA considers that it is essential for the Proponent to build community capacity and transfer skills from now onwards. This is required to prepare the community for the social and economic impacts of mine closure, and to equip people with skills to manage the MRM site for the long term.

Through stakeholder consultation (see section 3.2), the Proponent identified a number of socio-economic concerns relating to the Proposal (draft EIS section 12.6). These included:

- opinion that the Proponent may be communicating with the wrong people or not hearing the true concerns
- opinion that excessive consultation by the Proponent might lead to lowered participation
- concern about the risk of economic benefits being favoured at the cost of the environment
- concern about potentially reduced local economic benefits (e.g. less employment) due to a slowdown in mining because of the unforeseen need to reclassify waste rock, leading to the Proposal
- concern about potential impacts to aesthetic values including visibility of the NOEF from the Carpentaria Highway and possible alteration of river banks including vegetation
- concern about perceived potential impacts on water quality, air quality, bush tucker, fish or cattle, that may impact human health.

The Proponent concluded that these concerns could all be mitigated to low-level risks by the continuation of existing consultation strategies and through effective landform design and comprehensive monitoring programs (draft EIS section 12.6.2).

The stated social benefits of the Proposal include increased opportunities for custodians / Aboriginal leaders to be involved in the rehabilitation process and cultural heritage management activities, and continued partnership with Borroloola School to encourage education outcomes and pathways to employment (draft EIS section 12.5). The Proponent provided an Economic and Social Impact Management Plan (ESIMP; draft EIS section 12.8) as a tool for managing potential socio-economic impacts.

Submissions on the draft EIS opined that the Proponent had not provided a meaningful assessment of socio-economic impacts on the local community. An example of an issue not considered in the EIS is the effect of the injection of monies from agreements and employment into Aboriginal distributive kinship economies (NLC submission p. 26). Another example is the effect of MRM on community divisions and social cohesion (EDO submission p. 22). These issues are associated with the long term operation of MRM and are not specifically related to the Proposal under assessment. However, the NT EPA considers that consideration of potential socio-economic impacts of MRM operations (in addition to the Proposal) is also necessary as part of addressing community concern. This concern may have increased since it became apparent that waste rock had been misclassified, leading to the necessity of the Proposal (Section 1.1).

As outlined in section 1.3.2, MRM operations contribute to the local, NT and Australian economy and provide employment for local people. Implementation of the Proposal is predicted to lead to a greater investment (predicted operational expenditure \$3.5 billion,

or 64%, higher) over a longer period (to 2047 rather than 2036) compared to the currently approved Phase 3 operation (draft EIS section 12.5.2.4). The Proponent also predicted higher total employment, at 845 persons rather than 550 persons (draft EIS section 12.5.2.4; draft EIS Appendix Z table 2), for the Phase 3 operation.

Measures of previous economic contributions have been unclear, making it difficult for the community to understand the benefits or to compare them with predictions made in previous EIAs. To address this, The NT EPA considers that open and transparent reporting of the full economic benefits of the Proposal, including contribution to GSP, employment numbers, and the contribution to government revenue, would assist the Proponent in illustrating its ongoing contribution to the NT economy. Ultimately these economic contributions will cease following mine closure, and the effects are likely to be hardest felt in the local, remote area that has few other opportunities for employment and investment. The NT EPA is of the opinion that the CBT has the potential to contribute to long-term economic benefits for the local community through programs that increase the capability and capacity of local residents to generate their own employment and income far beyond the life of MRM and translate into intergenerational benefits.

The NT EPA considers that while the Proponent has addressed the Terms of Reference for the EIS, uncertainty remains around the potential local socio-economic impacts from the Proposal. Two items in the ESIMP provided in the draft EIS relate to social impact management and the targets are focussed on the prevention or management of complaints rather than the potential impacts (draft EIS table 12-21). The NT EPA has the view that the ESIMP does not outline mechanisms or targets for preventing, mitigating or managing the full range of potential social and economic impacts from the Proposal and the future closure of the mine.

The NT EPA considers that there are many interrelated social issues that could potentially be impacted by MRM operations and the Proposal (including future closure), as follows:

- Community cohesion: There is likely to be continuing social disharmony in the local community due to differing community values and attitudes towards MRM and the Proponent. Conflicts may arise if opportunities for participation and benefit are perceived to be inequitable across clan groups, gender or other diversity metrics.
- Community engagement and participation: Access to, and level of, participation in community activities/services could be positively influenced by the Proposal, especially through the CBT. This social metric requires effective engagement with the local communities.
- Community education: There is an opportunity for the Proponent to continue to contribute to education and to improve long term outcomes in the local community through the CBT. These benefits would be most beneficial if directed at increasing capability and capacity of the community to pursue opportunities that will extend beyond the scope and life of MRM operations.
- Access to, and control of, environmental resources: Access to environmental resources could be restricted if environmental impacts occur beyond the MRM site. For example, alterations in water quality in the McArthur River may affect fish numbers or health, thereby influencing fishing and other recreational/subsistence activities downstream from MRM. The NT EPA has defined an overarching environmental outcome (recommendation 3) to protect these resources.
- Health and wellbeing (mental, physical, spiritual): Impacts to cultural values may have a 'spiritual' impact on custodians/traditional owners.

- **Lifestyle:** The injection of money into the local community (including social and cultural activities) could have both positive (e.g. engagement) and negative social impacts (e.g. greater access to lifestyle choices that have a negative impact on health such as tobacco and alcohol). Future closure of the mine would lessen local economic activity and could have negative impacts if the transition is not effectively planned.
- **Community safety:** Social conflicts, changes in lifestyle and other social metrics discussed above could influence crime or violence in the community.
- **Aspirations and fears:** Some members of the community have concerns regarding potential future environmental impacts from the Proposal. The NT EPA considers that the Proposal should not have a significant adverse environmental impact and has made recommendations for achieving this. There is an opportunity for the Proponent to positively influence community aspirations through the CBT.
- **Early closure or care and maintenance:** This would result in unanticipated job losses and reduced or loss of financial contributions to the local, regional and national communities and governments.

In consideration of the current ESIMP for the Proposal (draft EIS section 12.8) and the potential social and economic impacts discussed above, the NT EPA considers that the Proponent should more comprehensively consider the potential social and economic impacts of the Proposal and how those impacts would be managed. In addition, it will be important for the Proponent to more effectively engage with the community. Section 7.3.2 and Recommendation 26 promote the establishment of a new Community Reference Group as a mechanism to engage meaningfully with a range of community stakeholders.

Summary – Socio-economics

The Proposal would result in additional investment on-site, additional employment and a production rate that is predicted to be higher than in recent years. It is reasonable to expect that revenue generated by the Proponent will continue to flow in the Gulf Region, the NT, and the rest of Australia. The NT EPA considers that the CBT should encourage meaningful engagement of local residents in a way that aims to deliver long term economic benefits to the local community. The NT EPA suggests that transparent public reporting of economic measures would increase community understanding of the economic benefits of MRM operations. The NT EPA also considers that the Proponent should more comprehensively consider the potential social and economic impacts of the Proposal and how those impacts would be managed. Effective engagement with the community will be important, as provided for in Recommendation 26 of this Report.

5.4.5 Conclusion against NT EPA objective

The NT EPA concludes that while there remains some uncertainty around the potential direct and indirect effects of the Proposal on the social, economic and cultural aspects of the environment, with the implementation of NT EPA recommendations in this Report, the NT EPA considers that impacts can be prevented, mitigated or managed; benefits can be maximised; and the level of trust can be improved.

The NT EPA notes the implementation of the Proposal will require a determination under the NTASS Act on the significance and acceptability of potential cultural impacts to sacred sites and a decision from the Minister on destruction or disturbance of an archaeological site. It will be important for the Proponent to ensure it has identified and engaged with appropriate custodians and traditional owners relating to these processes.

The NT EPA considers that, with the implementation of the recommendations above, the Proposal could be conducted in a manner that its objective for social, economic and cultural surrounds is likely to be met.

5.5 Human health

5.5.1 Environmental Objective

Ensure that the risks to human health are identified, understood and adequately avoided and/or mitigated.

5.5.2 Environmental values

In addition to its biophysical, social, economic and cultural values, the environment in the region of the Proposal provides for human health. The environmental values for human health in the region are:

- clean air for breathing,
- clean water from which food is harvested or that could be used for drinking or bathing, and
- clean food obtained from land, water and sea.

Good air quality must be maintained for people visiting the MRM site or nearby locations. Humans reside in the town of Borroloola (45 km in a direct line to the north-east) and small communities to the north of MRM (the closest is Devils Spring at 28 km). People may also reside in or visit temporary outstations (the closest is ~10 km to the north-east of MRM), other places such as Caranbirini Conservation Reserve (~20 km north of MRM) and fishing locations such as King Ash Bay, downstream of MRM and Borroloola (draft EIS figure 13-1). People are also temporarily exposed to air in the vicinity of MRM when travelling along the Carpentaria Highway, west and north-west of the NOEF. Predominant winds at MRM come from the north-east, and also the south-east during the Dry season (draft EIS section 13.2.5).

Good water quality must be maintained for aquatic food species that are consumed by people downstream from MRM, as further discussed below. The quality of any water used by people for drinking or bathing must also be maintained. Downstream of MRM, regional drinking water supplies are not derived from the McArthur River and come from sources that are not hydraulically connected to waters affected by the Proposal. The water supply of Borroloola, including surrounding Garawa camps, comes entirely from the Abner Sandstone Aquifer (Power and Water, 2018), that is recharged by rainfall in nearby outcrops up-gradient from the McArthur River (Hydrobiology, 2017). Water sources for smaller communities and outstations are assumed to be from shallow aquifers recharged by sandstone outcrops in the region (Hydrobiology, 2017).

It is unlikely that people would be exposed to McArthur River water at Borroloola or further downstream as people generally do not swim in the river due to the presence of estuarine crocodiles (Hydrobiology, 2017). People may consume or be exposed to McArthur River water upstream of Borroloola and downstream from MRM if visiting country. There is a very small risk that traditional owners may consume or be exposed to water at the MRM site if visiting (with approval from the Proponent) for cultural reasons, as several sacred sites within the MRM site contain waterholes (see Section 5.4.4.1). However, MRM is an operating mine site handling and processing large quantities of ore and rock each year; visits are restricted, fishing is prohibited and consumption of fish, animals or water on the mine site is not permitted.

A range of aquatic fauna, terrestrial fauna and some flora from the region are directly consumed by people. It is important that these species do not become contaminated as a result of the Proposal from water, air, land/sediment or by consuming species at lower trophic levels. Fish from the McArthur River are an important source of food for people.

Many visitors to the area come specifically for recreational fishing. About half of the local community go fishing on a weekly basis and all of them at least once a year (Hydrobiology, 2017). Other aquatic species consumed by people include freshwater turtles, freshwater mussels (Hydrobiology, 2017), and file snakes (NLC submission – Supplement p 7-122). Terrestrial food species may include wallabies, turkeys, goannas (Hydrobiology, 2017), and birds which may consume small fish (NLC submission – Supplement p 7-122). The land around MRM is used for pastoralism where cattle are grazed for human consumption (draft EIS p. 14-72). Local people also hunt feral cattle for consumption, and bush foods including berries and plums are consumed on an irregular basis (Hydrobiology, 2017).

5.5.3 Potential impacts

Impacts to human health may occur as a result of the Proposal from the following:

- Exposure to or inhalation of poor quality air that could include particulates (dust) – potentially containing lead or zinc, or other air emissions – particularly sulfur dioxide.
- Consumption of or exposure to contaminated water; onsite and downstream.
- Consumption of potentially contaminated beef, fish, reptiles or other bush tucker due to water or air contamination in the vicinity of MRM or downstream from it.

Such potential impacts could occur into the very long term.

5.5.4 NT EPA assessment

Air

Several pollutants of concern could impact on human health as a result of implementation of the Proposal. Sulfur dioxide (SO₂) is an irritant to eyes, skin and mucous membranes, and can be released from some materials at MRM (draft EIS section 13.1.2). Lead is a cumulative toxicant that can affect multiple systems of the human body and is particularly harmful to young children (World Health Organisation, 2018) if exposure is uncontrolled and on-going (draft EIS section 14.6.1.2.13.1). Zinc can cause short-term disease if inhaled in large quantities (ATSDR, 2005). Lead and zinc are both present in significant quantities at MRM.

There has been concern regarding the health impacts of previous emissions of SO₂ from spontaneous combustion that has occurred from the NOEF at MRM (NT EPA, 2017). Air monitoring results from that episode give context for the potential health impacts of any future emissions.

Results of monitoring for 14 months during 2015-16 showed that the concentrations of SO₂ at Devils Spring and Borroloola were well below the National Environment Protection (Ambient Air Quality) Measure⁸ (NEPM) criteria, indicating a low risk to human health (NT EPA, 2017; draft EIS section 13.2.4.3). The Proponent relocated one monitoring station to a site adjacent to the NOEF. A low proportion of recordings at that site exceeded the 1-hour NEPM criteria. The NT EPA did not consider these problematic because the NEPM criteria for ambient air quality are not directly applicable to measurements taken so close to a source and these recordings are more related to Occupational Health and Safety (OHS) rather than protection of public health (NT EPA, 2017).

⁸ Explained in NT EPA (2017)

A goal of the Proposal is to effectively manage waste rock. Achieving that goal would mean that the risk of spontaneous combustion and SO₂ emissions is significantly reduced. Modelling by the Proponent indicated that, in the case of future spontaneous combustion, SO₂ concentrations would be well below the guidelines at all nearby locations that may be visited by people (as listed in Section 5.5.2) (draft EIS section 13.3.2.3). The NT EPA considers that it is unlikely there would be impacts to human health from SO₂ emissions outside of the MRM site. Visitors to the MRM site could be effectively protected from exposure to SO₂ by adhering to the Proponent's standard mitigation strategies (draft EIS section 14.6.1.2.13). Nonetheless, emissions of SO₂ from any future spontaneous combustion would be indicative of a failure of PAF waste rock management strategies and would necessitate regulatory action. Therefore, the NT EPA recommends continued SO₂ monitoring adjacent to the NOEF.

Particulate emissions, including lead and zinc, have previously been monitored within and around MRM. Some exceedances of particulates and lead have occurred within the MRM site but have decreased following the implementation of dust controls (draft EIS section 13.2.4). Dispersion modelling by the Proponent indicates that particulate emissions from the Proposal, including lead and zinc, would be largely confined to the MRM site, especially in the vicinity of the open pit, NOEF, and processing plant (draft EIS section 13.3.2.3). The potential for health impacts of particulate emissions on visitors to the MRM site is mitigated by site inductions and adhering to the Proponent's standard mitigation strategies (draft EIS section 14.6.1.2.13).

The NT EPA recommends the continuation of a SO₂ monitoring program by the Proponent including continuous sampling and monthly assessments of data (draft EIS section 13.4.1.1). The program is currently under review and the Adaptive Management Plan will need to be updated according to the review's outcomes. The NT EPA notes that SO₂ levels may be well below concentrations that may impact on human health at nearby communities, but residents are concerned and it will be important for the Proponent to communicate regularly with community members on the status of air emissions and potential impacts on human health.

Recommendation 19

Approvals and decisions in relation to the Proposal shall include conditions that require the Proponent to monitor sulfur dioxide within 1 km downwind of the NOEF, to the satisfaction of the NT EPA and relevant regulator. The objective of this monitoring program should be to identify any increase in sulfur dioxide emissions from the NOEF and any potential air quality risk to human health outside the MRM leases for all stages of the Proposal.

The monitoring program shall be reviewed in accordance with Recommendation 27 and incorporated into the Adaptive Management Plan, to be developed in accordance with Recommendation 28.

The results of the monitoring program are to be reported by the Proponent to the relevant regulator and audited by the Independent Monitor every three years. The monitoring report together with the Independent Monitor's audit report shall be made available to government agencies, the Community Reference Group and publicly on the Proponent's and regulator's websites.

Water

The quality of water at the MRM site and downstream in the McArthur River has the potential to be impacted by the Proposal, as outlined in Section 5.1 of this Report. Potential contamination could include lead, zinc, other metals, or sulfates, and these could be released into the very long term. Consumption of water contaminated with lead or other metals could lead to unacceptable health impacts in people. The consumption of sulfates would be unlikely to lead to health impacts (Hydrobiology, 2017).

Recommendation 3 of this Report requires the Proponent to protect the environmental values of the whole of the McArthur River in all phases of the Proposal. The NT EPA considers that management actions taken to protect those values will largely mitigate risks and potential impacts to human health from water consumption or contact in the McArthur River.

The NT EPA recognises that, as an operating mine, MRM receives, holds and treats a range of contaminated water streams. Waterways on the mine site, in close proximity to mining activities, will have water of varying quality. The NT EPA recommends that people are advised not to drink water from or bathe in water from waterholes at the MRM site if visiting for cultural reasons. All visitors should be instructed by the Proponent to refrain from drinking any environmental water at MRM.

Consumption of food from the region

Concern has been raised in public submissions that lead and other toxic metals can enter the food chain and potentially accumulate and magnify through higher trophic levels (e.g. barramundi fish), with resultant impact to human health if/when these species are consumed by people (NLC submission). The Proponent has monitored metals in aquatic fauna since 2005 (MRM, 2017a). Results have indicated, at times, elevated levels of lead and other metals in aquatic fauna in creeks within the MRM site but not in the McArthur River (MRM, 2017a; Bardon, 2015).

Concerns regarding impacts to human health from the consumption of potentially contaminated fish and other aquatic species from the downstream reaches of the McArthur River, led to an investigation by the Department of Primary Industry and Fisheries (DPIF) and the Department of Health (DoH) in 2014. The investigation identified that concentrations of mercury, cadmium and lead were elevated in fish and shellfish caught at Borroloola. The mercury level, and to some extent the levels of other metals was due to uptake and bioconcentration of naturally occurring minerals.

The DoH concluded health impacts were unlikely as long as people were adhering to the recommended limits of consumption that have been communicated by the DoH for many years as a general health protection measure (which are largely based on limiting the consumption of mercury from fish). These limits vary according to species and are communicated to the public by the DoH using illustrated signage around Borroloola and MRM. The DoH reported that elevated metals in fish sampled at Borroloola were unlikely to be caused by MRM.

People in the region also consume freshwater turtles and other species, however the potential health risks associated with this are unknown (Hydrobiology, 2017). The Proponent and its consultants have concluded that there is a very low risk to human health posed by the consumption of aquatic fauna from the McArthur River downstream of MRM (MRM, 2017; Hydrobiology, 2017), and this was confirmed by an independent review (Hydrobiology, 2016).

Recommendation 20

Approvals and decisions in relation to the Proposal shall include conditions that require the Proponent to:

- i. **continue a monitoring program, to the satisfaction of the NT EPA on advice of the Chief Health Officer, to determine if aquatic fauna obtained from any reach of the McArthur River is safe to eat during all stages of the Proposal**
- ii. **publicly report the results of monitoring, including at appropriate locations in the region**

- iii. **maintain signage at waterways within the MRM site advising that fishing and harvesting of aquatic food species is prohibited, until the waterways recover and the risk of contamination from consumption of this aquatic fauna is negligible.**

MRM is located on an operating cattle station, where grazed cattle are intended for human consumption. In 2014 there was a case of at least one animal with elevated lead levels at MRM. Since that time the Proponent has implemented control measures to exclude cattle from mine-affected areas (MRM, 2016). Controls include mustering, strengthening fencing, additional fencing, ongoing blood sampling, and responsive culling if required (draft EIS p 14-72). The NT EPA considers that impacts to human health from eating beef that may be contaminated from the MRM site can be avoided by the maintenance of controls to keep cattle out of the MRM site.

Wallabies, goannas and turkeys may also access mine-affected areas and potentially obtain elevated levels of lead or other metals via the consumption of water or exposure to dust, and these may subsequently travel offsite and be hunted for human consumption. Maintenance of a cattle fence may not prevent the movement of these animals. The NT EPA recommends a precautionary approach, including avoiding hunting animals in the vicinity of the MRM site. Communication of this approach should be considered by the Proponent and the relevant regulator.

Summary

The Proposal presents low risks to human health by way of potential contamination of air (particulate and chemical), or potential contamination of water or sediments that may contaminate fauna species that are consumed as a food source. Potential impacts can be avoided by careful management of waste materials such that combustion reactions in the NOEF are minimised and contaminants are not released to the environment.

Recommendation 3 of this Report requires the Proponent to protect the health of the whole of the McArthur River and its environmental values as an overarching environmental outcome in all phases of executing the Proposal. The NT EPA considers that adherence to this overarching environmental outcome would largely mitigate the potential impacts and risks to human health from mine-derived metals and contaminants in the McArthur River. Recommendation 20 for continued SO₂ monitoring would assist in detecting any increase in combustion reactions in the NOEF.

It is essential that the Proponent clearly communicates results of monitoring programs so that the community is fully informed about the potential health risks (or lack thereof) associated with air emissions from MRM and the consumption of fish and other species from the McArthur River.

5.5.5 Conclusion against NT EPA objective

With the implementation of proposed management plans, mitigation measures and the recommendations above, the NT EPA considers that the Proposal can be conducted in a manner that is likely to meet its objective for human health, i.e. that the risks to human health are identified, understood and adequately avoided and/or mitigated.

6 EPBC Act matters

6.1 Matters of national environmental significance

The Australian Government Minister for the Environment and Energy has determined that the proposal is a controlled action under the EPBC Act as it is likely to have a significant impact on one or more Matters of National Environmental Significance (MNES). It was determined that the proposed action is likely to have a significant impact on the following matter protected by the EPBC Act:

- Listed threatened species and communities (sections 18 and 18A)

The NT EPA has assessed the controlled action on behalf of the Australian Government under an accredited assessment process. The Proposal has been assessed in a manner consistent with section 87(4) of the EPBC Act and schedule 4 of the EPBC regulations. In particular, this assessment has included consideration of the following plans, conservation advice and policies:

- Conservation Advice *Erythrura gouldiae* Gouldian finch (Threatened Species Scientific Committee, 2016a)
- Approved Conservation Advice for *Pristis pristis* (largetooth sawfish) (DoE, 2014)
- Commonwealth Listing Advice on northern quoll (*Dasyurus hallucatus*) (Threatened Species Scientific Committee, 2005)
- Conservation Advice *Erythrorhynchus radiatus* red goshawk (Threatened Species Scientific Committee, 2015a)
- Conservation Advice *Falcunculus frontatus* whitei crested shrike-tit (northern) (Threatened Species Scientific Committee, 2016b)
- Conservation Advice *Grantiella picta* painted honeyeater (DoE, 2015)
- Conservation Advice *Macroderma gigas* ghost bat (Threatened Species Scientific Committee, 2016c)
- Conservation Advice *Pseudantechinus mimulus* Carpentarian antechinus (Threatened Species Scientific Committee, 2015b)
- Conservation Advice *Tyto novaehollandiae kimberli* masked owl (northern) (Threatened Species Scientific Committee, 2015c)
- National Recovery Plan for the Gouldian finch (*Erythrura gouldiae*) (O'Malley, 2006)
- Sawfish and River Sharks Multispecies Recovery Plan (DoE, 2015b)
- National Recovery Plan For the northern quoll *Dasyurus hallucatus* (Hill & Ward, 2010)
- National recovery plan for the red goshawk *Erythrorhynchus radiates* (Department of Environment and Resource Management, 2012)
- Threat abatement plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses (DSEWPaC, 2012)
- Threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*) (DoEE, 2017)
- Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads (DSEWPaC, 2011a)
- Threat abatement plan for predation by feral cats (DoE, 2015a)
- Threat abatement plan for predation by the European red fox (DEWHA, 2008)
- Protocols for surveying and tagging sawfishes and river sharks (Kyne & Pillans, 2014)

- EPBC Act Environmental Offsets Policy (DSEWPaC, 2012).

This assessment report is provided to the Australian Government Minister for the Environment and Energy who will decide whether or not to approve the Proposal under the EPBC Act. This is separate from any Northern Territory approval/s that may be required.

6.1.1 Threatened species

The EPBC Act requires the protection and conservation of nationally listed threatened species (sections 18 and 18A). Seventeen fauna and no flora species listed under the EPBC Act are considered to potentially occur in the area that may be influenced by MRM and the Proposal. This list was generated using the DoEE's Protected Matters Search Tool (DoEE, 2018) using the bounding latitudes of 16.30° – 16.55° S and longitudes of 136.00° – 136.22° E. The potential for significant impact on these threatened species is assessed below.

The NT EPA has assessed these species to address the requirements of the EPBC Act. The information used in this assessment was provided by the Proponent in the EIS (draft EIS and Supplement) and/or provided by advisory agencies.

Information on the fauna around the Proposal was obtained from desktop studies and targeted field surveys. The DENR Flora and Fauna Division has advised that '*adequate survey effort has been directed to all threatened species that potentially occur in the area*'. Fauna surveys were generally consistent with the Australian Government guidelines (DSEWPaC, 2011a; DSEWPaC, 2011b; DEWHA, 2010a; DEWHA, 2010b).

6.1.1.1 Endangered species

Gouldian finch

The Gouldian finch (*Erythrura gouldiae*) is a small, seed-eating parrot finch native across northern Australia that has had a historical decline in abundance and distribution. It is listed as Endangered under the EPBC Act. It is a highly mobile species, shifting locations over days, months and seasons, largely influenced by the availability of water and suitable grass seed.

The Gouldian finch occurs widely across the region surrounding the Proposal. Since assessment of the MRM Phase 3 proposal in 2012, it has been discovered that this species is a regular visitor to the MRM leases in very small numbers. Since 2003 nine Gouldian finches have been detected within MRM during targeted surveys across multiple seasons. They have been recorded at two main locations within the mineral leases: *Corymbia terminalis*-dominated woodland west of the TSF and woodland dominated by *Eucalyptus tectifica* and *Eucalyptus chlorophylla* alongside Emu Creek. These habitats are widespread across the MRM leases. It is likely that small numbers of the species probably utilise extensive areas of the MRM leases sporadically, but the short periods Gouldian finches spend in each place limits their detectability and therefore prevents a precise understanding of the occupancy of the area by them.

Potential impacts to the Gouldian finch as a result of the Proposal include the removal of potential nesting habitat; removal of potential feeding habitat; and contamination of drinking water. These add to the potential impacts of ongoing MRM operations, including reduced suitability of habitat due to weeds, dust or a reduction in drinking water sources; and the deposition of contaminated dust onto food sources.

Potential nesting habitat for the Gouldian finch is *Eucalyptus leucophloia* woodland on rocky hills and within 3 km of drinking water. The Proposal would require the unavoidable removal of 4.2 ha of such potential nesting habitat (additional to clearing previously approved for the Phase 3 development). It is considered unlikely that Gouldian finches use these areas because the habitat is in small patches of about 1 ha

each, and no individuals have been detected there during intensive targeted surveys. Potential feeding habitat comprises several grass-dominated vegetation types that provide suitable seed in varying seasons, and that are within 5 km of drinking water. The Proposal would require the unavoidable removal of 5.1 ha of such potential feeding habitat (additional to clearing previously approved for the Phase 3 development). Approximately 9500 ha of potential feeding habitat would remain within the MRM leases. As such, the NT EPA considers that the proposed clearing would not significantly reduce the overall area of occupancy of the Gouldian finch.

The Proposal has been designed to minimise environmental impacts including to Gouldian finch habitat. A NOEF of lower height and larger footprint than the Proposed NOEF would require clearing of a greater area of potential nesting and feeding habitat. Proposed measures to further mitigate the loss of Gouldian finch habitat include: the exclusion of cattle stock from 452 ha of potential feeding habitat within MRM; updating fire management to promote grasses critical for Gouldian finches; and inclusion of establishment of relevant grass species in the completion criteria for rehabilitation of the TSF and NOEF.

The DoEE noted it would be important to include key food species for Gouldian finches in rehabilitation plans. The DoEE also noted that there is a considerable time-lag between the action of clearing the habitat (proposed for 2018) and the completion of restoration (scheduled to commence in 2032). As considerable suitable feeding habitat will remain, and be protected, within the MRM leases, the NT EPA considers that the proposed habitat clearing would not have a significant residual impact on this species.

A further 45 ha of potential feeding habitat could become unavailable or degraded due to effects of weeds or dust deposition resulting from MRM operations and the Proposal. The NT EPA considers that this would be largely prevented or mitigated by the continuation of existing weed control and dust management measures. Any reduction in the availability of drinking water sources would also limit the utility of potential nesting or feeding habitat for Gouldian finches.

Some reduction in water level is predicted as a result of MRM operations due to dewatering and groundwater interception measures. These are predicted to affect parts of the McArthur River and Barney Creek but Gouldian finches have not been previously observed at these sites despite intensive surveys, so no impact is inferred. The Proponent has not committed to any specific mitigation measures, but stated that if monitoring of water levels indicates that pools used by Gouldian finches would be threatened, potential mitigation measures would include the enlargement of pools or supplementary watering. The Proponent concluded that the local availability of surface water for drinking (or lack of it) would not affect Gouldian finches. The NT EPA considers it unlikely that Gouldian finch habitat would be significantly reduced or degraded due to the combined impacts of weeds, dust or reduced drinking water sources.

Any contamination of food sources could potentially impact the health of Gouldian finches. MRM operations and the Proposal could lead to the deposition of lead-rich dust on feed-seeds. However, Gouldian finches have never been observed in close proximity to high-traffic operations where contaminated dust deposition would occur. The NT EPA considers that existing and proposed dust mitigation measures would effectively prevent the risk of contaminating food sources of the Gouldian finch.

Reduction in the quality of surface water used for drinking could impact the health of Gouldian finches. Within the MRM leases, Gouldian finches are known to use small, isolated water holes in the upper reaches of Surprise Creek, Barney Creek and Emu Creek. Further potential drinking water sources include the McArthur River (although Gouldian finches have not been observed there during extensive riparian bird surveys) and lower reaches of Surprise, Barney and Emu Creeks. Some of these waters within the MRM leases could become contaminated with sulfates and heavy metals as a result

of implementation of the Proposal and these contaminants could cause health impacts in Gouldian finches. The proposed mitigation measures have been assessed in section 5.1. While sulfates and zinc are expected to be elevated in some surface waters within the MRM leases (according to the Proponent's modelling), this is only in areas where Gouldian finches are not known to drink. Also, the predicted concentrations of contaminants in surface water are substantially lower than concentrations that may be expected to impact on the health of Gouldian finches. With the effective implementation of Recommendations 3 to 13 for the mitigation of water contamination, the NT EPA considers that water contamination would be unlikely to affect the health of Gouldian finches.

The Proposal includes an indirect monitoring program for the Gouldian finch because this species is recorded too irregularly to detect changes in occupation. Instead, habitat quality indicators would be monitored, including the composition and density of food grasses and the availability and quality of surface water. The DoEE noted that it would also be important to monitor the quality of food grasses. The DENR Flora and Fauna Division has advised that this approach is appropriate.

In summary, if the proposed mitigation measures and NT EPA recommendations are effectively implemented (and adjusted as required following monitoring), the NT EPA considers that there would not be a significant residual impact on the Gouldian finch.

Northern quoll

The northern quoll (*Dasyurus hallucatus*) previously inhabited rocky habitats in the vicinity of the Proposal but it is considered marginal habitat for the species. The northern quoll is considered largely regionally extinct due to colonisation of the region by cane toads, however it is possible a small population remains locally in the preferred rocky habitats near water.

One small area of potential northern quoll habitat (2.5 km north of the Proposal footprint) could be indirectly disturbed by the Proposal, but it is considered unlikely that this habitat is used by quolls because they have not been detected during intensive surveys. The most likely area that quolls may persist in the region is upstream of the Proposal and would not be impacted. Due to the unlikely presence of quolls in any area to be potentially impacted by the Proposal, the risk of impact is considered low and no mitigation measures have been proposed. The NT EPA considers that the Proposal is unlikely to have a significant impact on the northern quoll.

Gulf snapping turtle

The gulf snapping turtle (*Elseya lavarackorum*) occurs in the river systems of the Gulf of Carpentaria, where it inhabits deep permanent freshwater gorges, preferring steep rocky gorges and banks with intact vegetation. It has never been recorded in the McArthur River. Suitable habitat occurs in the McArthur River downstream from the Proposal, within the Bukalara Plateau, which has been poorly surveyed due to access constraints. The Proponent concluded that there is a slight possibility the gulf snapping turtle occurs in this area and that any such population could be susceptible to any downstream impacts from the Proposal. The DENR advised that, due to the fact that no evidence has been found for the gulf snapping turtle in the area over the last decade of surveys, it is considered that the species is unlikely to occur in the McArthur River catchment. The NT EPA considers that, if the species does occur and if proposed management measures and interventions for maintaining flow regimes and water quality are effectively implemented, the Proposal is unlikely to have an impact on the gulf snapping turtle.

Other endangered species

The following species may occur (or have previously occurred) in the area of the Proposal but are unlikely to be impacted by implementation of the Proposal, as outlined

by the Proponent in the draft EIS. The NT EPA considers it unlikely the Proposal would have an impact on these species:

- curlew sandpiper (critically endangered) – seasonally present at the mouth of McArthur River that would not be impacted by the Proposal
- eastern curlew (critically endangered) – seasonally present at the McArthur River estuary that would not be impacted by the Proposal
- Australian painted snipe – occasional visitors to the region, never observed on site, and no suitable habitat would be disturbed as a result of the Proposal
- Carpentarian grasswren – considered to be locally extinct.

6.1.1.2 Vulnerable species

ARGETOOTH SAWFISH

The largemouth sawfish (*pristis pristis*) is a large cartilaginous marine/estuarine fish distributed across northern Australia whose juveniles migrate into the freshwater upper reaches of rivers to develop in the absence of predators. The sawfish is a regular migrant up the McArthur River, including the MRM leases, but has never been observed in the smaller tributaries of Barney Creek, Surprise Creek or Emu Creek. The sawfish migrates upstream during the Wet season, particularly during high flows following heavy rainfall events. Individuals survive the Dry season in isolated pools that remain in the McArthur River, fed by a baseflow of groundwater.

Potential impacts on the largemouth sawfish as a result of the Proposal include reduced water quality in the McArthur River, shrinkage of Dry-season pools in the McArthur River, and reduced river flows during rapid filling of the pit lake.

Reduced water quality could impact on the health of sawfish. The potential impacts on water quality in the McArthur River have been discussed in Sections 5.1 and 5.3. Providing that contamination of the McArthur River is mitigated in accordance with the relevant recommendations in this Report, the NT EPA considers it unlikely that water contamination from the Proposal would impact the largemouth sawfish.

As discussed in Section 5.3, the Proposal is expected to cause drawdown of groundwater that would reduce the water level in waterholes in the McArthur River close to the MRM site. These include Djirrinmini, Wurrini and pools in the diversion channel. There remains uncertainty regarding the potential reduction in size of pools due to the drawdown, and if this may limit the ability of any species (including sawfish) to inhabit these pools. The DENR advised that regular surveys of these waterholes during times of low water levels would be necessary to identify any impacts on the ecosystem or on sawfish. With effective monitoring and if necessary, the implementation of mitigation measures such as supplementary watering to refill waterholes (Supplement p. 7-88), the NT EPA considers that the potential impact on sawfish caused by drawdown of waterholes in the vicinity of MRM can be avoided.

The potential for reduced river flows due to rapid filling of the pit lake (following the in-pit disposal of tailings), and its potential impact on river ecology, has been discussed in Section 5.3.4.3. A proportionally high reduction in river flows could impact on the migration of sawfish. The NT EPA expects that the Proponent would need to demonstrate a sound understanding of environmental flow requirements prior to the granting of an extraction licence, for pit filling, in future. The DENR has advised that the Proponent's threshold for sawfish movement in the river is ill-defined.

Recommendation 21

Approvals and decisions in relation to the Proposal shall include conditions that require the Proponent to develop a non-lethal monitoring program for sawfish and

from the results, define a specific (measurable and time-bound) threshold for a significant decline in sawfish movement (based on data) that would trigger investigation and implementation of management measures. This threshold is to be developed to the satisfaction of the Australian Government Department of the Environment and Energy and the Department of Environment and Natural Resources, within 12 months of authorisation of the Proposal.

Potential entrapment of sawfish in a future pit lake could negatively affect sawfish if connectivity with the McArthur River was established in a future pit closure scenario. The NT EPA considers that it is not possible to accurately predict the most environmentally-sustainable solution for mine pit closure that will protect the McArthur River and its aquatic fauna in the long-term, without further site-specific information. Therefore it is not necessary or appropriate to make a judgement on pit closure scenarios in this Report.

If at some point in the future connectivity of a pit lake with the McArthur River is to be considered, then referral to the NT EPA will be required for an assessment decision. The entrapment of sawfish will need to be considered and addressed in its context as a value of the McArthur River, through that future assessment process.

The NT EPA considers that while some uncertainty remains on the potential impacts and effectiveness of mitigation measures, the proposed monitoring would enable detection of impacts and adaptation in management responses through the Proponent's Adaptive Management Plan. With the effective implementation of an appropriate trigger as required in Recommendation 21, the NT EPA considers that the Proposal could be managed in a manner that would not result in significant residual impacts on the largetooth sawfish.

Red goshawk

The red goshawk (*Erythrotriorchis radiatus*) is a bird of prey that inhabits forested coastal and near-coastal north and east Australia. It is likely that the McArthur River downstream of MRM supports several pairs of red goshawks and it is possible that red goshawks occasionally forage in riparian areas within the MRM leases. If the Proposal resulted in substantial contamination of the McArthur River, there is potential for impacts to downstream riparian areas that coincide with breeding habitat of red goshawks. Water contamination is likely to be mitigated by the implementation of measures in the EIS and outlined in Section 5.1.4 and is unlikely to be at a level that would impact the species. Risks to the red goshawk as a result of the Proposal are considered negligible.

Crested shrike-tit (northern)

The northern subspecies of the crested shrike-tit (*Falcunculus frontatus whitei*) is a bird that inhabits open forests and woodlands across sub-coastal parts of the NT and Kimberley region. It is a highly detectable species but has never been recorded at MRM. The closest record of the species was near Borroloola in 1914. It is not considered to be present in the vicinity of the Proposal and is therefore unlikely to be impacted.

Painted honeyeater

The painted honeyeater (*Grantiella picta*) is a wide-ranging, nomadic bird occurring across the eastern states of Australia. The habitat in the region is considered of only low importance for the species. They have been recorded near MRM on two occasions, in 1913 and 1986. The Proposal would clear about 200 ha (<1%) of the potential painted honeyeater habitat within MRM. The small scale of this clearing of non-limiting habitat suggests that habitat clearing as a result of the Proposal would not impact this species.

Ghost bat

The ghost bat (*Macroderma gigas*) is a large, carnivorous, cave-dwelling bat that forages in forests within about 2 km from their cave roosts. It is known to occur in several locations about 100 – 150 km to the east and northeast of the Proposal site. Suitable rugged habitat in the Bukalara Range, just east of the Proposal, could provide potential roost habitat for ghost bats, however the species has not been detected there despite targeted surveys. The Proposal would not remove or disturb any sites that could potentially contain roosting caves. Given this lack of disturbance and the low likelihood that ghost bats reside in the area, the Proposal is unlikely to impact the ghost bat.

Carpentarian antechinus

The Carpentarian antechinus (*Pseudantechinus mimulus*) is a small, carnivorous marsupial that has three discreet populations in the region to the east and northeast of the Proposal. It has never been recorded in the vicinity of the Proposal. Potential habitat occurs within MRM, and about 4 ha of this would be cleared by approved Phase 3 works and the Proposal. Given the small scale of this clearing and the low likelihood that this species occurs in the area, the Proposal is unlikely to impact this species.

Masked owl (Northern)

The northern subspecies of the masked owl (*Tyto novaehollandiae kimberli*) occurs patchily across the forests of northern Australia and has suffered a decline in population following a reduction in their prey, medium-sized mammals. There has not been a confirmed recording of the species in the region since 1914. The low, open woodlands that comprise the vast majority of the Proposal area are unlikely to be suitable habitat for the species. Nevertheless, it is possible that dispersing individuals may utilise dense vegetation corridors along the McArthur River. Due to the low detectability of the species, there is a small possibility that it occurs in the region. The approved Phase 3 works and the Proposal would clear about 21 ha of potentially suitable habitat, but given the low possibility the species occurs in the region, this is unlikely to impact on the species.

Other vulnerable species

The following species may occur (or have previously occurred) in the area of the Proposal but are not considered to be at risk of impact from the Proposal as outlined by the Proponent in the draft EIS. The NT EPA considers it unlikely the Proposal would have an impact on these species:

- plains death adder – likely to be locally extinct
- partridge pigeon (Eastern) – considered locally extinct
- bare-rumped sheath-tail bat – unlikely to be present in the Proposal area or to be affected by off-site impacts.

6.1.1.3 Conclusion

The NT EPA considers that there would not be a significant residual impact on the Gouldian finch if the proposed mitigation measures and NT EPA recommendations are effectively implemented. The NT EPA is also of the view that the Proposal could be managed in a manner that would not result in significant residual impacts on the largemouth sawfish provided that the NT EPA's overarching environmental outcome is met. The NT EPA is of the view that the most sustainable option for closure of the mine pit cannot be determined at present and that a future referral of closure option/s is likely to be required when further information is available. Other threatened species are not at risk of impact from the Proposal.

The NT EPA considers that, with the implementation of the recommendations in this Report and commitments made by the Proponent, the Proposal could be managed in such a manner that the potential environmental impacts and risks to all other threatened species would be acceptable.

7 Whole of environment considerations

7.1 Process safety

A process safety incident is a loss of control of material with the potential for high consequences. Examples include spills of hazardous substances, chemicals and hydrocarbons, release of contaminated water, fires or explosions which have the potential to impact human health and safety, the community, environmental values, company reputation and financial losses. Process safety incidents also include exposures to the environment that may impact over an extended period of time, such as long-term seepage from the TSF or NOEF contaminating groundwater or the McArthur River.

Process safety is a blend of engineering and management skills focused on preventing process safety incidents (Energy Institute, 2017). Process safety skills exceed those required for managing workplace safety as it considers how major hazards (rather than human safety hazards) are assessed and controlled. With effective implementation of the principles of process safety, the Proponent is better positioned to prevent major incidents occurring.

The NT EPA supports the Proponent's implementation of process safety, and considers regulatory oversight of process safety by the independent panels would provide an additional layer of oversight that enables the Proponent to demonstrate risks at the site have been reduced to a level that is as low as reasonably achievable (ALARA)⁹. With a clearly documented process safety plan that includes identified hazards, threats and controls to prevent major incidents from occurring, the regulatory agency can focus on ensuring the operator implements those critical controls (ICMM, 2017). Critical controls are those controls that would have the greatest impact on preventing the risks relating to a major process safety incident from occurring or would provide the greatest mitigation of the potential consequences.

7.2 Closure and rehabilitation

7.2.1 Consideration of a 'no project' scenario

A view was expressed during the EIS review that a 'no project' option should be considered. The EDO indicated that its clients were *generally opposed to the continued mining at McArthur River Mine because of the problems already created through bad decision-making, poor quality environmental assessments and mismanagement at the site [and clients] view the risks as too great and the benefits too few to justify the approval of the OBMP thereby allowing continued mining at the site until 2037.*

The NT EPA is of the view that a 'no-project' scenario would lead to unacceptable outcomes for the environment, as set out below. The NT EPA's priority is to protect the environmental values of the whole of the McArthur River having regard to the need to enable ecologically sustainable development.

⁹ For the purposes of this report, the terms ALARP and ALARA have the same meaning.

The scope of the EIS has considered the changed site management necessary for erroneous overburden classification and longer-term implications, not whether mining should or should not proceed. The company has an existing Authorisation under the MM Act and is therefore lawfully permitted to continue operating the mine. The NT EPA has nonetheless given serious consideration to the consequences of the responsible Minister not authorising the Proposal, and the implications of the mine closing early (for whatever reason).

If the Proposal is not approved, the Proponent may maintain its interest in the mine (and remain the title owner) or relinquish its title and close immediately (thereby surrendering the security).

The NT EPA considers the most realistic scenario of a decision not to authorise the Proposal would see mining continue in accordance with the current Authorisation until such time as authorised activities are completed, followed by a period of care and maintenance, which the EIS states would likely be prolonged. During care and maintenance, the Proponent might consider alternative designs to enable mining to continue.

In the unlikely event that the Proponent abandoned the site and relinquished its security bond, the NT Government would be required to take on the responsibility of stabilising and closing the mine site, using the security bond, to prevent long-term contamination of the McArthur River. The site is very complex and already heavily disturbed with an existing deep open pit in the floodplain, a waste rock dump that generates AMD, and a TSF that is considered a major geochemical hazard.

The skills, knowledge and capacity to plan and deliver successful, large-scale best-practice mine closure are not found in any government agency and are very different to the skills required to be an effective regulator. It is likely that the NT Government would require substantial external expertise to plan and undertake rehabilitation works. The procurement of engineering expertise and earthmoving contractors would likely be at considerable expense because, in contrast to the Proponent, contractors, quite reasonably, would be aiming to make a profit from the closure works.

It is likely that the cost of rehabilitating the mine site in accordance with a closure plan that incorporates leading practice methods would exceed the current financial security, particularly in view of government procurement procedures and lack of resources. In 2017 the DPIR, under a new policy to improve transparency, published the security bond amount for the McArthur River Mine. The current security is \$477 997 771. The underpinning calculations have not been revealed to the NT EPA, however, the IM in its most recent report stated that the closure costs were based on a strategy that could not be implemented and would be insufficient to manage and maintain the site post-closure (IM, 2017). The cost of rehabilitating the mine site in 2018 is likely to be substantially more than the current security. Mudd (2014), for example, estimated the cost of complete backfilling alone at \$800 million.

If mining was authorised to continue in accordance with the Proposal, the Proponent is likely to expend significant financial resources to close the NOEF and remove the TSF; expenditure that would be beyond the capacity of the NT Government and would only be possible with the Proponent's continued presence at the site. Additionally, the Proponent has the technical resources to build on its understanding of site closure requirements, and the requisite plant and financial resources to continue data collection and research, and test proposed solutions to the environmental challenges at the site while it continues to mine.

The socio-economic and cultural outcomes of a 'no project' scenario would be varied. There would be some positive cultural outcomes (preservation of sacred and archaeological sites) and some negative social and economic outcomes (loss of

employment opportunities and failure to realise royalty payments). However, the perceived costs or benefits of mine closure to the community could be overshadowed by the biophysical impacts to the environment likely to result.

The NT EPA considers that the Proponent's continued management of the site, with important lessons learnt from the past and acted upon, with stringent conditions attached to approvals to ensure identified risks and potential impacts are properly managed during operations, with increased focus on leading practice adaptive management, and with independent expert panels and peer reviews and enhanced transparency and disclosure, will be essential to achieving the best outcomes for the health of the McArthur River and its beneficial uses and environmental values.

7.2.2 Care and maintenance / unplanned early closure

Care and maintenance occurs when mining operations enter a period of temporary suspension whereby mining activity may recommence after short periods (one to two years) or long periods (more than two years). Care and maintenance periods could occur at various times during a project's life, and have occurred at MRM in the past.

Strategies for short-term and longer-term care and maintenance are included in the EIS (draft EIS Appendix S, Section 8.2.1) and the current expectations of the regulator are included on its website.¹⁰

The NT EPA considers that care and maintenance of this site will require similar environmental management resources and management intensity as the operating mine site. The significance of the geochemical hazards presented by the NOEF, TSF and mine pit domains mean that extended periods (in excess of two years) of poorly implemented and monitored care and maintenance could have catastrophic consequences for the McArthur River adjacent to and downstream of the mine. The NT EPA is strongly opposed to allowing mine proponents/operators to enter into extended periods of care and maintenance (greater than 2 years). If such circumstances arise at MRM, the NT EPA is of the view that consideration should be given to enforcing the following requirements¹¹:

- The Proponent/operator should justify the Proposal based on an independent assessment of the mine's financial viability.
- The site should continue to be progressively rehabilitated to maximise the area of rehabilitation and ensure that there are minimal discharges from all site domains.
- The Proponent must accept mandated directions from the regulatory authorities regarding the scale of rehabilitation that must be undertaken during the period.
- Monitoring and maintenance programs, and adaptive management processes, must be continued and results reported publicly.
- An annual status report reporting on progressive rehabilitation, maintenance and monitoring must be submitted to the regulatory authority and the public.

¹⁰ Mining Management Plan Structure Guide for Care and Maintenance Operations. DPIR guideline available at: https://nt.gov.au/data/assets/pdf_file/0004/405850/mmp-care-maintenance-operations.pdf.

¹¹ Adopted from Humphries, R., 2017. Improving NT Mine Rehabilitation – Key Reforms.

- The Proponent should be subject to an independent site economic status review by NT Treasury to determine whether or not the mine should remain in care and maintenance or whether it should be permanently closed and rehabilitated.
- Should permanent closure be recommended based on the above economic review or monitoring programs indicate that the mine cannot be managed appropriately in care and maintenance to prevent contamination of the McArthur River, the Proponent must implement its full authorised closure plan to the satisfaction of the appropriate regulatory authorities and the regional community.

Recommendation 22

Approvals and decisions in relation to the Proposal shall contain conditions that require environmental objectives to be established and achieved in case the mine site enters into care and maintenance. Environmental objectives should be reviewed by the relevant independent panel/s and approved by the relevant regulator/s after consultation with the Community Reference Group, custodians and traditional owners.

In the event that mining operations at MRM are closed early the Proponent indicates that the full implementation of a mine closure plan would be triggered (draft EIS Appendix S).

The NT EPA has reviewed the Proponent's Authorised MMP 2013-2015, which includes a preliminary closure plan and is of the view that the preliminary plan would be entirely unsuitable for closure of the MRM site, would not meet its stated objectives, would not satisfy ICMM principles (ICMM, 2003) and would not meet community expectations.

The NT EPA expects that the conceptual closure plan will be updated for any future Authorisation or Variation in consideration of the NT EPA's recommendations in this Report, including a periodic review by the independent panel and with objectives agreed by key stakeholders including the downstream community through a Community Reference Group, and will be implemented in the event of an early closure. The NT EPA considers that, at a minimum, controls to be implemented at the MRM site in early closure include:

- ongoing management of the NOEF to prevent spontaneous combustion
- placement of compacted clay layers over areas of PAF(RE) and PAF(HC) pending outcomes of finalisation of the closure plan
- adequate cover on the NOEF based on strategies outlined in the EIS and this Report, and success of cover trials. Evaluation of the option to relocate the PAF material back into the pit or new areas of the NOEF if there is a risk of NOEF cover failure, with appropriate post-closure management
- relocation of tailings to the pit, with options to mitigate any ongoing seepage at the TSF site (e.g. seepage trench, recovery bores)
- suitable management of the pit lake and maintenance of appropriate protection infrastructure (e.g. levee wall)
- ongoing vegetation and aquatic habitat establishment and maintenance in the McArthur River diversion and Barney Creek diversion channels
- development of a robust water management system with a focus on rehabilitating areas which contribute the poorest water quality
- development of a comprehensive water management plan that includes passive measures for managing poor quality water

- maximise water treatment and proactively discharge the maximum volume of good quality water from the site each Wet season
- ongoing groundwater and surface water monitoring.

The Proponent's Adaptive Management Plan should be used during operations to further develop and improve closure strategies as discussed in Section 7.4 of this Report.

7.2.3 Planned closure and rehabilitation

The Proponent was advised to assess closure outcomes over a 1000-year period for the Proposal. This requirement extends beyond industry standard practice for EIA and contains inherent uncertainties associated with predicting outcomes for extended periods into the future. Nevertheless, it better reflects the timeframe over which environmental effects are likely to occur and management will be required at MRM.

The Proponent focused primarily on the operational period of the mine and the shorter term closure period, but attempted to assess potential impacts for the full period where it was considered practicable and meaningful. The EIS notes that this strategy required different modelling approaches between short-term and long-term assessments, each with differing levels of confidence in the predictions. The NT EPA through this assessment must decide whether the predictions are meaningful and can be assessed and, if so, make judgements on the closure options for site domains.

The Proponent provided a Conceptual Closure Plan that included rehabilitation objectives, draft indicators and draft completion criteria to address its stated closure goals (draft EIS Appendix S Table 6-1). The NT EPA noted that inadequate detail was provided on assessment criteria (triggers) that would give early warning if management and mitigation measures were not working, and assessment criteria were not linked well to closure objectives. Contingencies proposed to be implemented if triggered were insufficiently detailed and no analyses were undertaken of the potential impacts of those contingencies. Subsequently, a framework for an Adaptive Management Plan provided in the Supplement (Appendix R) included more information on closure processes for the domains with some extra contingency measures. However, the NT EPA identified similar issues with the adaptive management framework, as discussed in Section 7.4 of this Report.

The Proponent commissioned numerous studies in an attempt to improve confidence in closure outcomes and to inform longer term decision-making. The data required to assess the veracity of predictions for some key elements of the Proposal, particularly the post-closure pit lake and the long term NOEF cover, were not obtainable for the EIS. In these instances trials and ongoing monitoring during operations are needed to reduce predictive uncertainty. The NT EPA has therefore elected to reserve its judgement on particular closure strategies presented in the EIS on the basis that decisions on long-term sustainability of some options cannot be made at this point in time and improved options may become evident as relevant information is obtained by the Proponent. New technologies and management techniques are likely to emerge in the mining industry during the ensuing 20 years offering potential solutions to some of the more challenging problems at the site. Closure options should be finalised three to five years prior to planned closure based on leading-practice contemporary requirements that meet the expectations of regulatory authorities, key stakeholders and the community.

To ensure that the Proponent remains on a trajectory to meet its objectives at closure, taking into consideration emerging technology and leading-practice closure strategies, the NT EPA is of the view that independent review of the Proponent's closure planning is required during mining operations.

Recommendation 23

Approvals and decisions in relation to the proposal will include conditions requiring the Proponent to provide funding to establish and operate a panel of independent experts to:

- i. review and advise on the development of closure and care and maintenance strategies for mine site domains, and the Proponent's trajectory towards achieving agreed closure objectives
- ii. review the risk of potential catastrophic failure of the mine levee wall and the McArthur River diversion channel in view of future closure objectives.

The panel shall be formed:

- iii. with an independent chair, appointed by the responsible Minister in consultation with the Minister for Environment and Natural Resources
- iv. on the advice of the relevant regulator/s and the Proponent.

The panel shall conduct a rolling 3-5 year review of the mine closure plan to assess the trajectory of closure options for MRM site domains and provide a report to the relevant regulator and the Independent Monitor that is made available to the Proponent, government agencies, the Community Reference Group and the public.

Terms of Reference for the panel shall set out the terms for roles and responsibilities, membership, timeframe for commencement and scope, reporting obligations and transparency and accountability. The Terms of Reference shall be finalised by the responsible Minister, in consultation with the Minister for Environment and Natural Resources acting on advice from the NT EPA, within 12 months of authorisation of the Proposal.

The structure of the panel and its Terms of Reference shall be reviewed by the Responsible Minister, in consultation with the Minister for Environment and Natural Resources every six years from the date the Terms of Reference are finalised.

The NT EPA has made a number of recommendations throughout Section 5 of this Report in relation to the minimum expectations it considers are required for the Proposal to satisfy the NT EPA's overarching environmental outcome and objectives in planning for and implementing closure options. These minimum expectations include:

- undertaking extensive physical, chemical and constructability testing recommended in Supplement Appendix H, that includes different GSL options as well as a GSL/CCL option to justify selection of the preferred GSL. Trials and observations of rehabilitated areas should:
 - verify erosion rates during operations to better plan post closure maintenance requirements
 - address the potential failure mode of the GSL cover system batter design during extreme storm events
 - assess temperature effects on the GSL
 - assess NOEF settlement
- funding an independent review of the geotechnical assessment and cover design

- installation of at least 500 mm compacted clay liner at base for new NOEF stages
- engineering and staging the NOEF construction to minimise contamination of groundwater during operations and to allow management to adapt if cover trials and observations identify significant long-term performance issues
- monitor dump temperature and settlement during dump construction, with particular focus on the performance of the Stage 2 final cover over the older end tipped and convecting dump portion of the NOEF
- place all PAF(HC) in 2 m lifts in the same way as PAF(RE) materials to minimise AMD loadings and reduce liabilities during all stages of dump construction in case of problems with the proposed final cover system
- interception and treatment of seepage from MRM domains including the NOEF and TSF to protect groundwater and surface water resources within the mine site from excessive contamination and improve recovery of the contaminated water resource
- careful design, testing and monitoring of the proposed interception trench/s to ensure high capture efficiency
- regular audits to confirm that TSF conditions are being adequately monitored and controls are being used when required in accordance with the operations manual
- further investigation into the source of the 140 – 200 L/s groundwater inflow into the underground workings
- deposition of tailings, preferably reprocessed, in the pit void with a water cover
- isolation of the pit from the McArthur River and maintenance of a robust levee wall while potential alternative long-term management options for the pit are determined
- trigger values to be specified for each groundwater monitoring bore as part of the operations adaptive management program
- monitoring of sulfate concentrations in waterways, particularly Barney Creek diversion and the old McArthur River channel, and subsequent/annual recalibration of models.

The NT EPA considers that ongoing stakeholder engagement among regulatory authorities, the broader community and industry is essential to ensure closure and rehabilitation objectives and completion criteria are agreed, in accordance with leading practice (DIIS, 2016; ICMM, 2003).

Since many of the strategies for closure of the key domains on the mine, and in particular the NOEF, are dependent on their management during mining operations, this engagement and agreement must be sought at the outset. The NT EPA considers that the broader community must have a role in reviewing and setting closure and rehabilitation objectives and has made Recommendation 26 for the establishment of a Community Reference Group as a means to facilitate community involvement.

7.2.4 Pit backfill consideration

The EIS proposes partial backfill of the pit following mining out of the pit resource with approximately 100 Mt (58 Mm³) of tailings, 15 Mt of non-benign waste from the final six years of mining operations and 5 Mt of PAF material stored temporarily within the mine levee wall area into the base of the final pit void. This equates to approximately 15% of the total waste streams, and results in some of the higher risk material on site being disposed of under a depth of more than 150 m of water (Supplement Appendix C).

Complete and partial backfill scenarios for the 'no project' scenario, as requested by the EDO, were not assessed by the Proponent. However, complete backfill and large partial backfill approaches were assessed in the EIS as part of planned closure (Supplement Appendix C). The Proponent argued against these scenarios, largely on the basis that both would make the mine economically unviable and a regulatory requirement to implement such a scenario would cause the mine to close prematurely. No cost estimates for backfill scenarios were provided in the EIS to support this claim.

Backfilling the pit comes with its own attendant risks. Nevertheless, the NT EPA is of the view that a large partial backfill approach, similar to that presented in Appendix C of the Supplement, should be considered as a contingency intervention in the event that cover trials indicate that long-term cover integrity is unlikely, as discussed in Section 5.1.4.1 of this Report.

The large partial backfill option would involve rehandling of all reactive PAF (PAF(RE)) materials and tailings into the pit, and establishing a medium-depth mine pit lake (similar to Supplement Appendix C – Option 3) as follows:

- The EOEF (with the higher acid generation risk PAF(HW) material) and the SOEF would be rehandled into lower benches of the final void.
- The tailings, PAF(RE) and PAF(HC) material would be co-disposed in the lower permeability section of the pit void.
- The existing NOEF PAF cell and Central West PAF cell would also be removed in their entirety. The total volume to be rehandled from the NOEF would be approximately 68 Mm³.
- The non-benign backfill mass would be covered with a nominal 5 m thick layer of LS-NAF(HC). The volume above this level would then be rapid filled from the McArthur River as discussed previously to form a mine pit lake approximately 100 m deep.
- A smaller NOEF with an area of approximately 450 ha to a height of 80 m would remain to the north of the current NOEF in the long-term. This NOEF would still contain PAF(HC) overburden and MS-NAF overburden in the core, MS-NAF material in the base and halo, and benign materials in the cover.

The NT EPA is of the view that such an option should be considered as a contingency in the Proponent's Closure Plan, and subject to review by the independent panel to be appointed in accordance with Recommendation 23.

7.2.5 Financial assurance

Glencore stated in its submission to the Scientific Enquiry into Hydraulic Fracturing in the Northern Territory that *we believe it is entirely appropriate that companies are required to provide an adequate level of financial assurance to ensure that post mine closure rehabilitation occurs without additional cost being imposed on the Government and community.* It also wrote that *the requirement for financial assurance does not negate a company's responsibility to rehabilitate in accordance with its mine closure plan. Security bonds, bank guarantees and similar sureties are a last resort security mechanism for Government (and the community) where a company fails to meet its responsibilities in relation to final mine closure and rehabilitation.*

The Proponent intends to maintain a presence on the site for nominally between 4 – 70 years after closure, depending on the outcomes of adaptive management and monitoring. However, the management of the site is likely to require an active presence for potentially hundreds of years, if not in perpetuity. In the absence of the Proponent, this will likely fall to government in the short to medium term.

There is a high risk that long-term, post-closure monitoring and maintenance costs, which are currently based on water quality monitoring for a period of 25 years following closure, are under-estimated (IM, 2017). The draft EIS states that costs are likely to be incurred for several hundred years. The consequence of this is that, based on current information, the calculated costs for post-closure monitoring and maintenance are not sufficient and in a scenario where the Proponent leaves the site, the NT Government (the NT taxpayer) would be required to fund any shortfall. The NT EPA is of the view that the Proponent should not be permitted to walk away without an appropriate financial assurance.

The NT EPA requested details regarding options for funding mechanisms and possible management arrangements and a clear preferred mechanism, agreed with regulators, to provide for adaptive management and reactive management phases, i.e. the full 1000 year period. In response, the Supplement states that *Section 43 of the Mining Management Act provides the Northern Territory Government with the necessary protection for rehabilitation costs or to prevent, minimise or rectify environmental harm. McArthur River Mining is only permitted to undertake activities authorised pursuant to its Authorisation. A security is required to be provided by McArthur River Mining which corresponds to those authorised activities.*

A review of the current security bond held by the NT Government will be completed when the next MMP is lodged in accordance with the MM Act. The Proponent considers that the review would cover rehabilitation of the site based on the current level of disturbance (Supplement Section 7.13).

The IM in its 2016 report commented that such a review would need to be comprehensive, paying particular attention to the predicted timeframe required for post-closure monitoring and maintenance, and allowing for the costs of:

- long-term monitoring of NOEF cover performance
- maintenance of the cover system, including inspection of geotechnical integrity
- collection and treatment of leachates (surface and groundwater), and active water management post-closure including management of the pit lake
- monitoring and maintenance of the mine levee wall
- monitoring and maintenance of the McArthur River and Barney Creek diversion channels.

In addition, the NT EPA expects that the security bond would be sufficient to meet the overarching environmental outcome of protecting the McArthur River from mine-derived impacts along its full length at all times; and that annual contaminant loads discharged to the river from the mine site must be contained such that there is no future increase above current annual loads.

The NT EPA understands that financial assurance is determined based on the works proposed in the Authorisation. Given the complexity of calculations to determine the security required for rehabilitation, monitoring and maintenance of the MRM site, and the importance of impartiality, the financial assurance required under the MM Act should be calculated by an independent body with expertise in the area of mining liability and security calculations.

Recommendation 24

An independent third-party assessment of the security that must be provided by the Proponent or Operator for rehabilitation of the Authorised activities at the McArthur River Mine site shall be conducted by a qualified person approved by

the responsible Minister. The security amount shall be sufficient to secure the site in a manner that meets the NT EPA's overarching environmental outcome. The independently calculated amount and final amount of the security shall be published on the relevant regulator's website with any variation between the amounts explained.

The security amount shall be reassessed every three years if an assessment of the security amount by the regulator has been undertaken during that time in accordance with the Authorisation for the McArthur River Mine.

The mining regulator is considering making MMPs publicly available. The NT EPA strongly supports the notion of transparency, in accordance with leading practice (ICMM, 2003; EITI, 2016; MCA, 2005) and is of the view that the MMP and Authorisation should be publicly available and updated whenever they are varied. To avoid the publication of commercially sensitive or confidential information, the MMP should be divided into two parts; a publicly available overview and environmental management section, and the detailed mining section, which would remain confidential.

Recommendation 25

The Mining Management Plan (overview and environmental management section) and the Authorisation for the McArthur River Mine Overburden Management Project shall be made available to the public on the relevant regulator's website and in hard copy at an appropriate location in Borroloola (e.g. Borroloola Public Library).

A number of commenters have expressed serious concerns about the low likelihood that the Proponent will remain at the site for the period required to ensure closure requirements are met. Recommendations have been made by the EDO and others to implement mechanisms to ensure that the Proponent's parent company, Glencore, is liable for rehabilitation costs given the lack of 'chain of responsibility' legislation in the NT.

The Queensland Government enacted its *Environment Protection (Chain of Responsibility) Amendment Act 2016*. It introduced new provisions to enable environmental protection orders to be issued to 'related persons' to ensure that companies and associated parties meet their environmental responsibilities including bearing the cost of rehabilitation. The Scientific Enquiry into Hydraulic Fracturing in the Northern Territory recommended that the Government enact provisions establishing a chain of responsibility for gas companies and related parties to ensure compliance with environmental obligations. This recommendation has been accepted by the NT Government. In this context, the NT EPA is of the view that such provisions should be applied more broadly to include the mining industry and that the NT Government should consider a broader application of chain of responsibility in its environmental regulatory reform program.

7.3 Governance

7.3.1 Existing oversight and governance

The NT EPA has identified a number of issues with the previous and current system of governance for the mine. These include:

- The previous governance regime has not demonstrated it can deliver good environmental outcomes as evidenced by the extent and magnitude of problems at the site, nor has it held the Proponent accountable for the problems that have developed during the mine's life.

- There is a lack of transparency as the main regulatory instruments for the mining lease (the MMP and Authorisation) can only be viewed by the Proponent and the DPIR. There is currently no avenue for the community and other agencies, including the NT EPA, to view these.
- Extensive environmental monitoring and studies are undertaken by a wide range of different consultants, including the IM and the Proponent's ITRB and NIRB. The NT EPA's impression is that there is no detailed review or trend analysis of the monitoring results and therefore the Proponent's proposed adaptive management approach would not be supported by the monitoring or enable proper regulatory oversight and transparent public accountability. There is no regular public reporting of the findings to enable the community to form a view about the mine's performance.
- There are two committees constituted by the Proponent that review the TSF domain (ITRB) and NOEF domain (NIRB), periodically. These committees are termed 'independent review boards' and were commissioned by the Proponent on an instruction from the DPIR. However, the NT EPA notes that the ITRB and NIRB are not as their name suggests 'independent' and have essentially become consultants and advisors for the Proponent rather than independent bodies as originally intended. The terms of reference for the ITRB are not clear.
- The Independent Monitor conducts an annual review of risks, monitoring activities and environmental assessments undertaken at the mine. The subsequent reports are a valuable reference but are very large and take almost a year to complete. They are therefore mostly out-of-date and backward-looking by the time they are published. The risks are assessed independently each year without reference to overarching objectives and with no trend analysis to indicate whether risks are reducing or trends are showing improvement or deterioration in key parameters, and no overall narrative on the acceptability of environmental outcomes of each year's management.
- The NT EPA understands that the Proponent's current community reference group is not functioning as it needs to. In March 2016, it was opened up to all members of the public but is generally poorly attended.
- The benefits of mining and development are generally shared broadly across the economy, however the impacts are usually localised. Local communities are often at a disadvantage, in terms of access to technical expertise and understanding and the time and people resources, to effectively engage with mining developments by which they are impacted. They are often reliant on third party stakeholders like NGOs, public policy advocacy bodies, and research and academic institutions to provide community accountability measures to safeguard the public interest.

7.3.2 Proposed oversight and governance

The NT EPA recognises that there are a broad range of stakeholders of the environment and its values in which the McArthur River Mine is located. A robust system of governance should recognise the roles of stakeholders and where appropriate, provide processes of interaction, engagement and decision-making for these stakeholders. The NT EPA recognises that any governance structure applied to the authorisation of the Proposal, should not be so onerous that it prevents the Proponent from conducting its business.

The NT EPA proposes an improved governance structure incorporating the following principles:

Involvement of the broader NT community, not just the local community:

- Establish a new Community Reference Group with a membership that is representative of the broader public interest and stakeholders (regional and sectoral) that have an interest in the Proposal.
- Involve this Community Reference Group in a civic leadership role in setting environmental objectives for operation, and objectives and criteria for closure and relinquishment.
- Engage the broader NT community in review of the mine's performance.

Transparency and accountability:

- The Proponent clearly reports on its environmental performance to the public.
- Independent panels' environmental reporting is clear and transparent.
- The Community Reference Group has a role in communicating the mine's performance to the local and broader community.
- Environmental management components of the MMP and conditions of Authorisation are available to the public.
- The IM's oversight is publicly available.

In revising the governance of the Proposal to meet these principles, it is recommended that the new structure gives consideration to the following:

- To improve regulatory transparency, the MMP should be divided into two parts; an overview and environmental management section (which will be publicly available) and the detailed mining section (which will remain confidential to the Proponent and the DPIR). The Proponent is to annually prepare a summary of the results and findings of all monitoring and its performance against environmental management objectives, and report to the relevant regulatory authorities (the DPIR and the DENR). The summary report should be made public within 30 days of provision to the regulator.
- panel/s of independent experts, as per Recommendations 8, 11 and 23 of this Report, funded by the Proponent, would receive data/investigation reports from the Proponent in relation to performance of the TSF, NOEF and closure strategies and relevant proposals under the Adaptive Management Plan. The panels would provide advice and recommendations to the relevant regulator/s for continual improvement, and report to the public (within 30 days of receipt by the regulator) and the IM. Reporting would be on an annual rolling basis, for example the relevant independent panel would report on the TSF in year 1, the NOEF in year 2, and mine closure planning in year 3.
- The IM, appointed by government (the DPIR and the DENR) and funded by the Proponent, would audit the MRM monitoring and operational performance reports every three years. The IM would consider advice from the independent panel/s, assess and report on risks and trends in environmental outcomes, and make recommendations to the regulator/s and the Proponent as to possible improvements that can be made to the Adaptive Management Plan and the MMP. This information would be made publicly available. The information could also be used by the NT EPA for reporting to the Minister under clause 15 of the EAAP as required.
- Establishment of a Community Reference Group, with an independent chair appointed by government, and comprised of key stakeholders, particularly custodians or their representatives, and members representing the broader public interest.

The Community Reference Group in the final point should be established to facilitate transparent engagement in the decision-making on closure and rehabilitation of the mine

and, in particular, the translation and communication of highly technical information into readily understood, clear statements of objectives to be achieved and progress towards achieving them, and the evaluation and costing of mine closure options.

The objective of the Community Reference Group should be to transparently represent the public interest in decisions about the mine. To achieve this, the NT EPA considers that the group should be chaired by a person in whom the public would trust. To establish and build trust, the group membership should remain independent from the regulator and Proponent.

Recommendation 26

Approvals and decisions in relation to the Proposal shall include conditions that require a Community Reference Group to be established that has the following roles:

- i. **communicate the mine's performance to the local and broader NT community**
- ii. **advise on the most appropriate method for the Proponent to report information that is required to be made publicly available**
- iii. **provide a structured forum for review and discussion in setting environmental objectives for adaptive management, operation, care and maintenance, mine closure and the evaluation and costing of mine closure options**
- iv. **provide a forum for discussing economic and social post-mining impacts**
- v. **translate technical information into communication that is readily understood by the community, clear statements of outcomes to be achieved and progress in achieving them for both operational and closure matters.**

The Group shall be chaired by an independent person appointed by government, who is held in high regard in civic life and has expertise in taking the community interests into account and experience in the position of chair.

The Group shall comprise members who represent the local community and broader Northern Territory community, as well as key stakeholders, particularly custodians and Traditional Owners.

A Terms of Reference for the Group shall be developed to the satisfaction of the NT EPA and agreed by the relevant regulator/s and the Department of the Chief Minister. Details regarding the establishment of the Community Reference Group, including roles and responsibilities, membership, timeframe for commencement and scope, reporting obligations and accountability should be decided within 12 months of all approvals being received for the Proposal.

The structure of the Group and its Terms of Reference shall be reviewed every six years from the date the Terms of Reference are finalised.

7.4 Adaptive management

The Proponent's approach to LOM and closure management establishes a number of closure monitoring and management phases, including short-term adaptive management; long-term proactive monitoring; and long-term reactive monitoring programs. The EIS contains numerous references to the implementation of an adaptive management framework to manage the Proposal during the 'adaptive management stage', which applies to operations and closure for a nominal period of 70 to 80 years.

The MRM site is highly complex and beset by environmental management challenges as a result of arguably deficient management systems, processes and decision-making over 25 years. The understanding of key aspects of the mine site remains largely conceptual and therefore uncertainty is a major component to be managed in implementing the Proposal should it be approved. Adaptive management may provide a means to ensure environmental outcomes can be achieved at MRM based on best contemporary knowledge and technology.

However the NT EPA is wary of the adaptive management approach. There have been a number of instances where management systems and processes failed to react in a cohesive and agile manner to avoid and manage on-site issues with potentially serious environmental consequences.

Effective adaptive management is far more than simply a process of monitoring activities and changing management direction; it involves exploring alternative ways to meet management objectives, predicting the outcomes of alternatives based on the current state of knowledge, implementing one or more of these alternatives in a timely way, monitoring to learn about the impacts of management actions, and then using the results to update knowledge and adjust management actions. In practical terms, adaptive management is a very difficult process to do well and involves a high level of organisational commitment and maturity on the part of the operator and regulator.

A number of commenters expressed concern about the Proponent's frequent reference to adaptive management in the draft EIS and failure to include meaningful detail to demonstrate an understanding of its requirements and challenges. The NT EPA requested further detailed information and clarity on how the adaptive management process within the MRM context would be implemented. The Proponent met with the DENR in its preparation of its response and an Adaptive Management Framework (Supplement Appendix R) was subsequently provided in the Supplement. While the typical conceptual elements of an environmental management plan were included in the Proponent's high level framework, it was evident that a significant amount of further work is required to turn the adaptive management framework into a robust Adaptive Management Plan. For example, appropriate performance objectives, relevant performance targets, intermediate triggers for intervention, and identification of proven interventions were not clearly stated and interventions were either unlikely to be adequately responsive or were 'to be developed' as or when required.

Attempts to incorporate adaptive management into the environmental impact assessment and approvals context have been less than successful to date. This is due to a lack of baseline data; vague and poorly-specified objectives; triggers and limits that have not been properly quantified; inadequate monitoring; vague or absent interventions and contingencies; and a lack of transparency. A failure to recognise the adaptive management process in the regulatory framework and particularly the lack of legal enforceability makes its success unlikely. The NT EPA makes a number of recommendations below to address these obstacles.

The Proponent has presented a significant amount of data and analysis in the EIS to support the Proposal. In many cases, sufficient baseline data exists to enable an assessment of impacts from the mine (e.g. surface water quality of the McArthur River) and to support adaptive management. In some cases, data is deficient and will need to be gained before management decisions can be made (e.g. data gained from NOEF cover trials, data on groundwater connectivity and ecological responses to contaminant loads to inform the final pit lake option). The collection of the baseline data necessary to inform future decisions will need to be incorporated into monitoring programs as part of the Adaptive Management Plan.

Monitoring at MRM has evolved and expanded over time to meet different needs. The NT EPA is of the view that the Proponent should conduct a full review and synthesis of

all monitoring programs, both on and off the mining leases, including ground and surface water, metals in freshwater fauna, macroinvertebrates, fluvial sediments, dust and soil to inform modelling and coordinated management activities on the mining leases. This will ensure that monitoring is cost-effective and purposeful, and is capable of informing all parties that the agreed management objectives are being met as a result of the implementation of the Proposal. The monitoring programs must be included as an integral part of the Proponent's Adaptive Management Plan so that management responses to exceedances of trigger criteria, which are well below compliance or impact thresholds, are likely to be timely and effective. The review of the monitoring program should be oversighted by the IM.

It is important that adaptive management processes occur under a strong regulatory regime that is capable of enforcement. It is important that the processes involve public scrutiny and engagement to ensure accountability. Ideally, intermediate triggers should be included to prompt further investigation, and triggers for management action or intervention should be included that are sufficiently below absolute impact limits to ensure action is taken in time before the impacts exceed pre-defined acceptable limits. Actions should reflect the current state of knowledge and best available practice, technology and management techniques. Evaluations should be periodically conducted by independent experts and reported to the regulator and the public to ensure transparency and accountability.

Recommendation 27

Approvals and decisions in relation to the Proposal shall include conditions that require the Proponent to conduct a complete review and synthesis of all monitoring programs that assess impacts of mining activities on the environmental values and beneficial uses of the McArthur River, in accordance with the NT EPA's overarching environmental outcome in Recommendation 3. The revised monitoring program shall be reviewed by the independent panel/s and Independent Monitor within nine months of authorisation of the Proposal, and then approved by the relevant regulator/s.

The revised monitoring program shall be incorporated into the Adaptive Management Plan.

The Proponent will need to develop an Adaptive Management Plan that incorporates and reconciles all applicable aspects of environmental management associated with the environmental objectives to be met for the current authorised activities and the Proposal. The plan must be reviewed by relevant independent panels, be subject to consultation with the Community Reference Group and agreed by relevant regulatory authorities and the NT EPA, before being approved as part of the Authorisation under the MM Act and other relevant regulatory instruments (e.g. WDL).

For the Adaptive Management Plan to be approved, the relevant regulator/s must have reasonable assurance that the adaptive management approach will sufficiently reduce predictive uncertainty, be capable of implementing realistic and achievable management interventions to prevent unacceptable impacts; and adequately manage residual risk.

The existence of an Adaptive Management Plan does not in any way derogate from the Proponent's legal obligation to notify the NT EPA of changes to the Proposal under clause 14A of the EAAP in accordance with Recommendation 2 of this Report.

Recommendation 28

Approvals and decisions in relation to the Proposal shall include conditions that require the Proponent to prepare an Adaptive Management Plan that includes the following key elements:

- i. **clear, measurable environmental objectives for all significant environmental risks and potential impacts**
- ii. **measurable performance indicators to show that objectives are on target to be met**
- iii. **pre-determined triggers to warn of potential for performance indicators to be exceeded, as informed by monitoring**
- iv. **pre-determined, realistic and achievable contingency interventions to maintain performance indicators if triggers are consistently exceeded**
- v. **clearly defined management measures/actions that are capable of being implemented in a timely way to meet performance indicators and environmental objectives**
- vi. **monitoring in accordance with relevant Recommendations in this Report to determine whether management measures are effective and to inform the need for adjustments to management measures or need for alternatives**
- vii. **a continual feedback system to ensure appropriate actions are initiated when triggered and environmental objectives are always being met**
- viii. **continual development of new management actions as required based on knowledge gained from experience at the site and elsewhere across industry.**

All key elements should be auditable. Performance indicators, triggers and actions in the Adaptive Management Plan are aimed at ensuring the specified objectives are met.

Before approvals or decisions are given or made for the Proposal, the Adaptive Management Plan shall be reviewed by the Independent Monitor or an appropriately qualified, independent third party, and the review findings and plan provided to relevant regulator/s, the NT EPA, the Community Reference Group and be made available to the public.

The process for developing the Adaptive Management Plan must be inclusive and transparent to all stakeholders. Stakeholders (regulatory authorities, government, and Aboriginal custodians and interest groups) should be engaged early and throughout the adaptive management process with ample opportunities to provide input to objectives, understand the potential impacts and agree to a process for adjusting management actions over time. The NT EPA's recommended Community Reference Group, which is proposed as part of the governance structure for the Proposal, is likely to provide a conduit for stakeholder participation and facilitate an understanding of what measures are proposed to protect the McArthur River from mine impacts.

It is important that adaptive management processes occur under a strong regulatory regime that is capable of enforcement. In the absence of approving legislation that explicitly provides for adaptive management, an adaptive management approach must be incorporated into conditions of the mining authorisation. The Authorisation for the Proposal under the MM Act must be conditioned in a way that establishes legally binding obligations to adapt when monitoring data shows change is necessary to protect the environment, and clear legal guidance on what is required in implementing the framework. Conditioning the requirement for and implementation of an adaptive management plan is insufficient in itself.

To ensure transparency, the Adaptive Management Plan must be available to the public, and progress in its implementation, including monitoring results, must be reported to

regulators, stakeholders and the public. This will require some emphasis on improved data analysis, synthesis and communication of outcomes to different audiences.

Recommendation 29

The Authorisation for the Proposal must provide for approval, implementation and review of the Adaptive Management Plan. To ensure clarity and enforceability, conditions of the Authorisation must:

- i. clearly set out the required management objectives and performance indicators**
- ii. provide clarity on the triggers for changes to management actions, and responsibility and evidentiary basis for decision-making**
- iii. establish the timeframe for initiation of certain actions if triggers are exceeded, including decisions to discontinue an activity and clarify responsibility and evidentiary basis for decision-making**
- iv. establish a process for adjusting triggers that includes the regulator**
- v. establish transparent monitoring, reporting and review requirements**
- vi. establish processes to ensure transparency and stakeholder engagement in Adaptive Management Plan design and implementation**
- vii. set out the mechanism for periodic review and approval of amendments to the plan.**

The Adaptive Management Plan and its implementation must be reviewed by the Independent Monitor every three years, with the outcomes of the review made available to the relevant regulator/s, the NT EPA, the Community Reference Group and the public.

Recommendation 30

Where trends indicate that performance indicators and environmental objectives will not or are unlikely to be met by implementing the adaptive management plan, the NT EPA must be notified of any resultant changes to the Proposal required under clause 14A of the Environmental Assessment Administrative Procedures.

The NT EPA considers that adaptive management will be challenging to implement at MRM. To do it well will require effective policy guidance; a great deal of expert thinking and planning; a culture of and commitment to continual improvement and openness; a transparent governance framework; adequate resourcing and strong regulatory input and oversight.

The NT EPA is in the process of drafting guidelines for adaptive management and will release the draft guidelines for public review. When finalised, the Proponent will need to consider the guidelines when developing and implementing its adaptive management approach.

8 Conclusion

The McArthur River Mine (MRM) is an existing lead and zinc mine that has been operating since 1993. In 2012, the then Department of Natural Resources, Environment and the Arts and Sport assessed the Phase 3 Development proposal, and it was subsequently approved by the then Minister for Mines and Energy in 2013. The MRM is authorised for the continuation of mining to 2036, and is operating under an approved Mining Management Plan (MMP) covering the period 2015 to 2018.

The basis for referring the Proposal to the NT EPA was the reclassification of waste rock 2.2. The classification system used by the Proponent while operating the open cut mine to 2014 did not match the actual characteristics of the rock being mined and led to significant under-estimation of the volume of reactive (potentially acid-generating) waste rock. As a result, a large proportion of the waste rock was not handled or stored on the site in a manner to avoid or minimise future seepage of runoff of metals from the site. Exposure of this reactive rock to air and water enabled chemical reactions to occur, resulting in the generation of acidic/metalliferous/saline drainage, and in some cases, spontaneous combustion within the northern overburden emplacement facility (NOEF). The plume of sulfur dioxide from the NOEF in 2014 attracted widespread attention.

To manage this issue, the Proponent has presented a proposal to redesign the NOEF (the principal waste rock dump on the site), to securely store reactive waste rock types that were not accounted for in the original Phase 3 design. The Proposal would result in the NOEF increasing in height from 80 m to 140 m; with the total footprint increasing from 485 ha to 511 ha. Additionally, the Proposal includes updated options for closure of key domains such as the NOEF, tailings storage facility and the final pit void which take account of the revised rock characteristics.

The mine has a 25 year history in the region from operating as an underground operation to its subsequent conversion to open cut. The history of the mine has been complex and at times, contentious. The NT EPA notes from submissions during the EIA process that there are substantial concerns about current environmental impacts and serious concerns from some that future impacts will be worse. Several submissions during the review of the EIS recommended that a 'no project' option should be considered.

The NT EPA considers that, to some extent, these concerns reflect a lack of integrated information about actual water quality and biological conditions in the McArthur River, compounded by the difficulty in accessing the results and findings of monitoring programs, and a view that there is not rigorous regulatory scrutiny of the mine's risks and environmental performance.

The NT EPA is mindful that the Proponent has an existing Authorisation and is therefore lawfully permitted to continue operating the mine. The scope of the EIS considers the changed site management necessary and closure implications of erroneous overburden classification, not whether mining should or should not proceed. Although not the Proposal before it, the NT EPA gave careful consideration to the 'no project' option. In doing so, it examined the existing condition of the receiving environment as well as the Proponent's modelling and predictions for future environmental impacts and risks that may arise from current and future operations.

Based on a review of available monitoring data, the NT EPA has concluded that the McArthur River, in terms of water quality and aquatic ecosystems, is in good condition at present. While impacts to water, air, terrestrial and aquatic habitats and biota are generally restricted to the mine site at present, there is potential for future off-site impacts to occur as a result of the Proposal.

In conducting this EIA, the NT EPA analysed the Proposal; the existing environment; the potential impacts and risks of the Proposal and the significance of those impacts and risks; and the proposed avoidance or minimisation/mitigation measures. It also had regard to the principles of ecologically sustainable development (ESD). In consideration of all these elements, the NT EPA formed a view that a central, overarching environmental outcome needed to be achieved. The McArthur River and the values it supports is the critical aspect of the receiving environment for the Proposal that links all identified key environmental factors and that must be protected from mine-related degradation. The NT EPA therefore considers that to meet its environmental objectives,

and the principles of ESD, the McArthur River must be maintained in a healthy condition at all times.

The NT EPA takes a strategic and precautionary approach in making **Recommendation 3** to require that the Proposal and all future stages of the mine are implemented in a manner that: requires the health of the McArthur River to be protected along its entire length at all times from mine related impacts; and that the annual loads of lead and zinc discharged to the McArthur River in future years do not exceed the loads discharged in 2017-2018. This **overarching environmental outcome** is the basis for the recommendation that the Proposal should be allowed to proceed.

The NT EPA considers that there is scope for significant improvement to management systems and review processes for the Proposal. This Assessment Report presents a comprehensive and robust package of recommendations that provide for improved: source control of contaminants; environmental monitoring; governance arrangements; transparency; and community engagement. Together, these recommendations provide multiple lines of protection, with the central aim of achieving the **overarching environmental outcome**.

To improve monitoring's ability to inform management and mitigation measures, the NT EPA recommends the Proponent revise and implement a monitoring program (**Recommendations 13**) that: quantifies impacts to water quality at appropriate points; quantifies loads of lead, zinc and other contaminants of concern entering the McArthur River; measures parameters that may indicate risks to the health of ecosystems and humans; measures trends in water quality; validates predictions and tests model assumptions; and has appropriate site specific triggers to management action. The NT EPA recommends that the results of all monitoring programs are made publicly available.

To improve transparency and allow for constructive scrutiny, the NT EPA recommends changed governance arrangements to replace existing arrangements, including a **Community Reference Group** and **independent panels**.

The Community Reference Group (**Recommendation 26**), chaired by a person of public trust and appointed by government, would provide for clear communication between broader community interests and mining operations and closure objectives.

Independent expert panels (**Recommendations 8, 11 and 23**) would provide external and transparent oversight and reporting, to advise government and the community on a three-year rolling basis on key aspects of the Proposal including the NOEF, tailings storage facility (TSF) and closure planning. The role of the Independent Monitor (IM) would remain, taking into account reporting from the expert panels. The IM report, the mining Authorisation and appropriate sections of the Proponent's Mining Management Plan would be publicly available.

The NT EPA is concerned that significant environmental impacts could occur as a result of a major incident, e.g. failure or overflow of the TSF or other events that may lead to uncontrolled release of contaminated water or tailings. To strengthen internal processes and ensure that these risks to the environment are recognised, minimised and would be appropriately prevented and managed, the NT EPA recommends three yearly reviews of critical controls for stability and seepage by the expert panels on all domains on the site. These reviews would enable the regulator to ensure critical controls are implemented that would most likely prevent such events.

The Proponent presented a preferred closure option involving: in-pit disposal of all reprocessed tailings and reactive waste rock over the last six years of mining; rapid filling of the pit void to create an isolated pit lake; and ultimately a flow-through lake connected to the McArthur River. While the NT EPA has reviewed the large amounts of information generated by the Proponent pertaining to these closure options, it is of the

view that closure is not proposed for at least 20 years and therefore, judgements on the merits or otherwise of closure options are premature in the absence of comprehensive data on long term outcomes and the likelihood of improved technologies and more appropriate solutions to emerge over time. Even so, the NT EPA is firmly of the view that any option must meet the NT EPA's **overarching environmental outcome**.

The NT EPA considers that effective long term containment of mining waste, post-closure or following unforeseen closure, is essential to ensure protection of the environment, particularly the McArthur River. The NT EPA has recommended that mine closure planning be an integral part of mine planning and that progressive rehabilitation is undertaken according to an approved schedule during operations. This would lower the risk of environmental harm during and after the life of the Proposal including any period of care and maintenance. The NT EPA recommends the Mine Closure Plan be updated regularly and in cooperation with a Mine Closure Expert panel, involving broad stakeholder representation. The mining security bond required under the *Mining Management Act* should be revised based on the updated Mine Closure Plan, and independently assessed, to ensure the costs of rehabilitation and post-closure liabilities are not borne by the NT Government and the community, in the event of the Operator abandoning the site or becoming insolvent.

The Proponent has proposed adaptive management as a tool that could, if well designed and implemented, provide a framework for sound management and structured decision making to initiate changes in programs to achieve the required performance when evidence of problems appear. The NT EPA considers that adaptive management should be complemented by a strong regulatory regime. It is important that the processes include public scrutiny and engagement to ensure accountability. The NT EPA makes **Recommendations 28** with respect to adaptive management.

The NT EPA makes **30** recommendations as an outcome of the EIA of the Proposal. These recommendations are for the Proponent and decision-makers to consider with respect to any conditions of approval, future mine management plans, and in the execution of the proposed action.

The NT EPA is of the view that the Proposal, if implemented in accordance with the **overarching environmental outcome** and the recommendations of this Report, has good prospects of ameliorating an environmental problem at the mine, and as such, a 'no project' scenario is more likely to result in uncontrolled and unacceptable outcomes for the environment.

The NT EPA considers that, subject to the implementation of the recommendations in this Assessment Report and the commitments and safeguards listed by the Proponent in the EIS, the Proposal can be implemented and managed in a manner that is likely to meet the NT EPA's objectives and avoid significant or unacceptable environmental impacts and risks.

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Appendix 1 – History of the McArthur River Mine

Year	Events
1992	<ul style="list-style-type: none"> Mount Isa Mines (MIM) submitted the EIS for the McArthur River Project, an underground mine, to be operated by McArthur River Mining Pty Ltd. The Environment Protection Unit of the Conservation Commission of the Northern Territory evaluated the EIS and produced Assessment Report 15 for the McArthur River Project proposed zinc-lead-silver mine.
1994-1995	<ul style="list-style-type: none"> The underground operation commenced in 1994 and the first shipment out of Bing Bong took place in mid-1995.
2003	<ul style="list-style-type: none"> The Proponent (then Xstrata as owner of McArthur River Mining Pty Ltd) submitted a Notice of Intent (NOI) to change the underground operation to an open cut operation (Phase 2 expansion), including the diversion of the McArthur River around the open cut. The then NT Minister for Environment and Heritage determined that an EIS was necessary. The Australian Government determined that the proposal constituted a Controlled Action under the EPBC Act.
2005	<ul style="list-style-type: none"> In July 2005 the Proponent was authorised by the NT Department of Primary Industries, Fisheries and Mines (DPIFM) to develop a Test Pit to provide a bulk sample of the ore for metallurgical testing. Stage A of the Test Pit involved the construction of a pit to a depth of 60 m to the east of the underground operations. In August 2005 the Proponent submitted the draft EIS for the Phase 2 expansion (open cut) to the then Environment Protection Agency. Issues raised in public consultation were extensive.
2006	<ul style="list-style-type: none"> In February 2006 the then Minister for Environment and Heritage, Ms Marion Scrymgour, received Assessment Report 51 on the Phase 2 expansion and supported the report's only recommendation that the open cut project should not proceed. In April 2006 the then Minister for Mines and Energy, Mr Kon Vatskalis approved the expansion of the Test Pit (Southern Extension). The extension enabled mining to continue and the avoidance of retrenching the mine workforce. In July 2006 the then Minister for Environment and Heritage required the Proponent to prepare a Public Environmental Report (PER) for Phase 2 after receiving a notification of an alteration to the project. In August 2006 the then Minister for Environment and Heritage, Ms Marion Scrymgour, received Assessment Report 54 on the altered Phase 2 expansion, and recommended that if the project was approved it should be subject to stringent conditions. Assessment Report 54 made no recommendations. In October 2006, the then Minister for Mines and Energy, Mr Chris Natt, approved the Phase 2 expansion (conversion of the mine to open cut). The amended Mining Management Plan (MMP) incorporated the conditions recommended by the Minister for Environment and Heritage, including independent monitoring of the mine's environmental impacts and a larger security for rehabilitation liability. In October 2006, the Commonwealth Minister for the Environment and Heritage, Mr Ian Campbell, granted approval for the proposal under the EPBC Act. In December 2006, the Northern Land Council commenced proceedings on behalf of a number of traditional owners challenging the validity of the approval process for the conversion of the underground mine to open cut and diversion of the McArthur River.
2007	<ul style="list-style-type: none"> In April 2007, the Supreme Court found the responsible Minister's approval invalid. The NT Government and the Proponent filed an appeal against the Supreme Court's decision. In May 2007, new legislation was passed in the NT Parliament to declare valid the authorisations and mining management plans associated with the approval. Support for the legislation was not unanimous within the Martin government with three Labor Party Members of the Legislative Assembly (M. McCarthy, K. Hampton and A. Anderson) crossing the floor. Minister for Environment and Heritage, Ms Marion Scrymgour absented herself from the legislative assembly vote on the bill. The authorisation of the mine included the establishment of the independent monitor; a \$55 million security for the first year of the development; and a \$32 million Community Benefits Package.

Year	Events
	<ul style="list-style-type: none"> In May 2007, the Yanyuwa, Gurdanji, Garawa and Mara people (Aboriginal applicants) challenged the Commonwealth Minister for Environment and Heritage in the Federal Court over the approval of the proposal under the EPBC Act.
2008	<ul style="list-style-type: none"> In June 2008 the Federal Court (Mansfield J) decided against the Aboriginal applicants. The Aboriginal applicants appealed the decision to the Full Court of the Federal Court and the appeal was upheld. In December 2008, the Full Court overturned the Commonwealth Minister's approval. Work stopped on the open cut mine. In December 2008, the Independent Monitor published its first report and covered the 2007 operational period of the mine from October 2006. The IM found considerable data gaps through the technical review for the Proponent's monitoring and reporting for the review period, as well as a general inadequacy of interpretation of monitoring results both by the Proponent and external consultants. The IM recommended that the check-monitoring undertaken by the regulator could be improved to ensure the Proponent's monitoring requirements and results were being appropriately checked.
2009	<ul style="list-style-type: none"> In February 2009, the then Commonwealth Minister for the Environment, Heritage and the Arts, Mr Peter Garrett, approved the open cut mine. Work on the mine resumed. For the 2009 operational year, the IM found: excessive water storage in TSF Cell 2, which posed a significant risk of overtopping and embankment failure; seepage migration from the TSF to Surprise Creek; and fugitive dust emissions from the mine site ROM pad/ore crushing area.
2010	<ul style="list-style-type: none"> For the 2010 operational year, the Independent Monitor found: adverse impacts of seepage from the TSF detected in Surprise Creek; extreme risk of embankment failure or overtopping of the spillway of the TSF; and concern with visual method for classifying NAF/PAF and potential for misclassification.
2011	<ul style="list-style-type: none"> In May 2011, an accidental release of diesel (approximately 28 000 L) from an open valve led to contamination of groundwater in the vicinity of the mine's power plant. The Proponent subsequently implemented a product recovery and groundwater monitoring program. McArthur River Mining Pty Ltd was convicted and received a fine for breach of the MM Act. For the 2011 operating period, the IM reported that NAF waste had a high sulfur content (>5% total S) and recommended a review of MRM's classification of NAF wastes, as well as review of the mineralogy of the NAF, PAF and acid consuming (AC) waste (Section 9.9.2, EES, 2012).
2012	<ul style="list-style-type: none"> In February 2012, the draft EIS for the Phase 3 Development Project was lodged with the Department of Natural Resources, Environment, the Arts and Sport (NRETAS). In July 2012, Assessment Report 69 on the Phase 3 Development Project was provided to the Minister for Natural Resources, Environment and Heritage.
2013	<ul style="list-style-type: none"> Areas of spontaneous combustion on the NOEF were observed by the Independent Monitor during the March 2013 site inspection (IM, 2014). MRM geologists advised that reactive PAF (i.e., spontaneously combusting) materials were mainly associated with the Black Bituminous Shale, particularly in the northeast corner of the pit (IM, 2014). In June 2013, the Phase 3 Development Project was approved by the Minister for Mines and Energy, Mr Willem Westra van Holthe. The Proponent's monitoring program recorded exceedances in the maximum permitted concentration for lead (Pb) as outlined in Food Standards Australia and New Zealand (2009) in fish species caught at SW19 (site downstream of Barney Creek haul road bridge). It was determined that the source of contamination was the haul road. There was no evidence of mine-derived Pb in the McArthur River (IM, 2014). For the 2012-2013 operational reporting period, the Independent Monitor found: a significant change in the understanding of geochemical risks, with the proportion of PAF waste rock understood to be around 50% rather than the previously estimated 30%, and the recognition that a further 30% of materials had potential for saline and metalliferous pH-neutral drainage. This resulted in revisions to the proposed closure concepts and implications for the management of water. The IM also noted: volume of water stored on the surface of the TSF was a concern; quality control during construction of TSF Cell 2, Stage 2 inadequate; and quality control for construction of clay liners at the NOEF may not be in accordance with design specifications with potential for impact on assumed performance.
2014	<ul style="list-style-type: none"> In April 2014, NT Worksafe investigated complaints of a sulfur dioxide (SO₂) plume over the Carpentaria Highway and breathing apparatus being used around the mine. In July 2014, the Department of Mines and Energy (DME) and the Department of Health (DoH) concurred with the IM's recommendation to sample for lead in fish species commonly consumed. Monitoring intensity was increased. An independent review of data was commissioned by DME to determine the potential effects

Year	Events
	<p>of consuming affected species on human health. The report concluded that “the risk to human health posed by consumption of fish, prawns and mussels from the McArthur River system is considered low” (Hydrobiology, 2016). Revised monitoring as instructed by DME includes the collection of early and late Dry seasons samples, community consultation in regards to the species of food fish collected and site locations for assessment, as well as biannual regional sampling in adjacent river catchments.</p> <ul style="list-style-type: none"> • In July 2014 the NT EPA decided that the MRM Overburden Management Project required assessment under the EA Act. • In October 2014, the NT EPA issued a notice under Section 48 of the <i>Waste Management and Pollution Control Act</i> which required the Proponent to carry out an environmental audit to monitor and determine the impact of SO₂ emissions from the mine. The Proponent installed air quality monitoring stations at the nearest residential locations (Borrooloola - 45 km north-east and Ijarra (Devil Springs) - 28 km north of the mine).
2015	<ul style="list-style-type: none"> • In April 2015, the NT EPA issued a new order to carry out the environmental audit program under Section 48 as the Proponent had failed to adequately address the conditions of the October notice. The Proponent was issued a Penalty Infringement Notice as a result, which was subsequently paid. Monitoring for the Environmental Audit Program commenced on 22 June 2015 and ran for 14 months over both Wet and Dry seasons. • 63 truckloads of PAF(RE) were incorrectly classified as MS-NAF and placed on the SOEF.
2016	<ul style="list-style-type: none"> • In December 2016 the NT EPA Pollution Hotline was notified by MRM that a collision had occurred on the Carpentaria Highway with one of their road trains resulting in the spillage of two semi-trailers of lead/zinc concentrate onto the highway and surrounding land. The spillage was cleaned up by the Proponent to the satisfaction of the NT EPA.
2017	<ul style="list-style-type: none"> • In March 2017, the draft EIS for the MRM Overburden Management Project was made available for public comment.
2018	<ul style="list-style-type: none"> • In July 2018 the NT EPA completed the assessment of the MRM Overburden Management Project and provided Assessment Report 86 to the Minister for Environment and Natural Resources.

Appendix 2 – Public submissions on the draft EIS

Submission no.	Submitted by
1*	Environment Centre of the Northern Territory (ECNT)
2	Northern Land Council (NLC)
3*	Environmental Defenders' Office NT Inc. (EDO)

*Submissions 1 and 3 included attachments that are not reproduced here.

Environment Centre NT

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Attention: Rod Johnson

Northern Territory Environment Protection Agency

Darwin NT 0800

Mode of delivery: By email eia.ntepa@nt.gov.au

17th May 2017

RE: Draft ENVIRONMENTAL IMPACT STATEMENT – McARTHUR RIVER MINE (MRM): Overburden Management Project

Whilst the Environment Centre NT (ECNT) appreciates the opportunity to provide comment on the proposal to manage the MRM Overburden and the MRM closure plan, we are deeply concerned that this EIS offers a bad value proposition.

By this we assert that the site status is now far worse than what previous authorisations have ever contemplated. Over the life of this mine the NT Government have failed to prosecute multiple breaches, which we fear may ultimately leave future generations of Territorians with the liability of a significant and unexpected impact into perpetuity.

We are hopeful that this assessment represents an opportunity to ensure that the operator meets the full liability of mine rehabilitation. At the same time we are asked to contemplate taking on the inevitable risk that comes from extended operations and an increased volume of waste to be managed.

It is therefore imperative that this process sets new standards for both the operator, whose rehabilitation requirements must be adequately scoped; and the regulator, whose capacity and commitment to comprehensively monitor performance and enforce requirements - including prosecuting breaches of authorisation - needs revival and reinforcement.

We would also like to add, that even with the extension to the date of comment ECNT has been given, we have not had the capacity to read and assess the full EIS due to the inadequate time given relative to the volume and complexity of the material provided. We believe this is detrimental to the protection of the environment and wellbeing of the stakeholders impacted by this project.

We are available to discuss any of the issues raised in this submission. Shar Molloy can be contacted on 0488 112 350 or 8901 7783.

Yours sincerely

Shar Molloy
Director
Environment Centre NT

Justin Tutty
Management Committee
Environment Centre NT



Notes re Appendices:

Various scientific reports directly related to this EIS have been included in our appendices and have been relied on to address the complex technical issues related to this EIS. Whilst the reports are addressed to the Environmental Defenders Officer (EDO), ECNT worked in collaboration with the EDO to obtain these assessments. Full permission from the EDO has been given to ECNT to reference and include these reports in our submission.

McArthur River Mine – Terms of Reference – General Information (Appendix A)

As part of the Final Terms of Reference under section 2.1 (Appendix A) Glencore have been requested to provide a history of the development of the McArthur River Mine to date, including disclosure of the context and nature of prior approvals. Whilst some aspects have been minimally addressed across chapters 1,2 and 3, the disclosure by Glencore does not adequately meet the terms of reference request regarding 2.1 General Information.

ECNT have participated fully in formal processes around environmental assessment of McArthur River Mine, and can offer further detail.

Certain features of decision making around the original mine deserve exposition. Barrister Tony Young (now a Federal Circuit Court Judge) wrote in Land Rights News, January 2015, that:

In early 1993 the Northern Land Council, acting on behalf of the Yanyuwa traditional owners of the McArthur River mouth and the Pellew Islands and the Gurdanji traditional owners of the mine site, wrote to the NT and Commonwealth governments seeking to be heard on aspects of the proposal, particularly social impacts on the Aboriginal people at Borroloola and environmental impacts on the McArthur River.

The letter was ignored.

Judge Young tells that:

The Yanyuwa .. asked for continuing and public environmental monitoring of the impact of the mine on the McArthur River. The Northern Territory government and Mount Isa Mines refused to consider this.

By Glencore's account, the expansion from underground to open-cut mining sounds straightforward:

An EIS was lodged as part of the formal assessment process to the NT, based on the guidelines issued in 2003. This was followed by the submission of an EIS Supplement (December 2005), Public Environmental Report (July 2006) and Mining Management Plan (September 2006).



But this description leaps over the significant fact that the PER was prepared only because the initial EIA was unsuccessful.

In February 2006, then Environment Minister Marion Scrymgour announced that the open cut plan would not be endorsed by her department:

“The proposal does not ... meet the test of sustainability - the EPA’s assessment provides a compelling argument for caution. ... I have therefore advised Xstrata that their EIS did not convince me that the uncertainties associated with mine expansion could be managed.”

In leading to this recommendation, the Environmental Assessment Report (AR51, NRETAS) noted, alongside concerns regarding realignment of the river:

There is potential environmental risk of mining operations and its components (including the tailings storage facility, the overburden emplacement facility and flood protection bund) posed by its location within the primary channel of a major tropical river. This includes the long term management of materials (sediments and contaminants), and their potential impact on ground and surface waters (and subsequent impact on local ecology) both during and post mining operations.

When, after reviewing a subsequent Public Environment Report, the Minister advised that the expansion would not be explicitly denied a second time, Environment Minister Marion Scrymgour nonetheless noted:

significant and long term risks of contaminants entering the river and ground water—the proposed tailings facility would not be accepted in Queensland and Victoria;

All parties must by now be wondering if the standards of those states should have been applied.

Traditional Owners, with support of the Northern Land Council, challenged this approval in 2007. Work on the expansion was ordered to stop when the Supreme Court ruled in favour of the Owners, and declared the approval invalid. NT Government controversially recalled a midnight session of parliament to change the Ratification Act and retrospectively approve the expansion.

The fiercely contested and highly controversial nature of the approval of the first stage of expansion to open cut at McArthur River is highly relevant context. It is significant that the initial rejection of the first stage of expansion has been omitted from the proponent’s version of events in subsequent applications. Tis EIS specifically calls upon the proponent to provide this context.

While not rejecting the project a second time, the NT Government acknowledged significant public concern over the project. Minister for Mines and Energy Chris Natt said the appointment of an independent monitor was a condition of the project being approved.

It is significant, then, to note that the subsequent 2012 Phase 3 application ignored, and even explicitly rejected, relevant information and advice on risks and alternatives from that same independent body. ECNT participated fully in the formal processes around the Phase 3 assessment, echoing a number of recommendations of the Independent Monitor, which are only now being considered. It is dismaying to find that decisions that should have been agreed during the previous assessment were ignored at the cost of significant unnecessary environmental harm, and are only now being considered, conditional upon the miner being rewarded with a further extension of operations.

We have included in the Appendix of our submission the report of Associate Professor Gavin M. Mudd¹ who also adds detail regarding the ‘History of the Project’, particularly information regarding classification of the overburden material. Accurate data regarding the characteristics of the waste rock mined each year, where it has been placed and how it has been managed is vital data that is missing from the proponent’s submission and is necessary to inform this assessment.

As Mudd writes

Documenting this history is not merely a simple recount of the MRM project, it is fundamental to establish why acid mine drainage risks have been so poorly recognised previously, leading to the major issues of smoke plumes from the PAF waste rock and concerns over seepage impacts on groundwater and surface water resources and eventually the need for this current EIS. Without such detailed history – and the data to go with it – it limits confidence in the current EIS and its associated assessment of PAF waste rock and AMD risks.

We support Gavin Mudd’s recommendation:

The EIS Response Document must include a complete historical data set of all mining activity to date at MRM. The key aspects must include an annual data set of ore mined and milled, ore grades, concentrates produced, tailings generated and waste rock mined. In addition, a careful account should be provided of where all waste rock has been placed to date – including the estimated PAF and NAF quantities for each area of waste rock management.

¹ Assoc. Prof. Gavin M. Mudd, May 2017, *McArthur River Mine Overburden Management Project – Draft Environmental Impact Statement*. P.1 – P.3



Chapter 3 – Project Description and Justification

TSF and Tailings reprocessing

DME, in their response to the 2016 IM report, acknowledged:

“The most significant risk from current operations relates to the operation of the TSF”

ECNT welcomes the recognition that the tailings should not be simply capped at the end of mine life, but must be reprocessed and returned to the open cut pit. This was a recommendation we made in the previous (2012) assessment. Our recommendation was made as a matter of urgency, not just for the long term management of tailings post-mining, but in response to the poor performance of the TSF cell 1.

ECNT and Gavin Mudd in his comments of this EIS², raise concerns that there is little evidence provided to show that reprocessing the tailings is technically and economically viable. The complex issue technical issues of reprocessing tailings is not adequately addressed with only a two page review. ECNT is concerned that if MRM determines that reprocessing the tailings is not a viable financial option, it will not fully rehabilitate the site, including returning the tailings to the open cut pit. Thus it is imperative that the EIS Response address the following recommendations (Adopted from Gavin Mudd):

- **Provide a clear case for the technical and economic viability of tailings reprocessing, especially how this may improve long-term environmental outcomes for the MRM site after the completion of all activities and rehabilitation.**
- **Include detailed costings for the various rehabilitation scenarios, especially the case where tailings are simply transferred from the current dam to the former pit.**
- **Include a future scenario where the tailings are simply transferred from the storage dams to the former open pit mine.**

Mine Wastes

We support Gavin Mudd’s³ recommendation to clarify the difference between low capacity (LC) and high capacity (HC) in a language that can be easily understood, including the difference it makes to mining activities and rehabilitation.

The EIS Response Document is to provide a better and clearer explanation of the distinction of mine wastes as ‘high’ or ‘low’ capacity. This includes detailing the importance of this classification and the impact of not easily being able to segregate this material in daily mining activities according to this classification.

² Ibid, p. 3-4

³ Ibid 4-5



McArthur River ecosystem – including mine pit lake and river flow through

Whilst the level of technical information in this current EIS is mostly thorough, the proponents plan to create a mine pit lake and redivert the McArthur River to its original path through the mine pit lake is of utmost concern. Community feedback and scientific opinion confirms these concerns.

ECNT met with numerous Borroloola residents from the 13th to the 15th April in town locations and on various outstations. Whether community members thought the mine should be closed immediately or whether the members thought the mine should continue operations, every single person was alarmed and did not approve of the McArthur River mine being reverted to flow through the mine pit lake containing the tailings and waste rock materials.

Scientific expert opinion confirms the intuitive assessment of the local Borroloola residents. Dr Garcia⁴ in her assessment of the current MRM EIS states that “the possible negative consequences to the McArthur River food web and those that rely on the food web by re-establishing the original path through the pit lake could be catastrophic and long-lasting such as the potential local extinction of an already threatened species *Pristis pristis*”. She also expresses concern about introducing a deep pit lake into the channel of McArthur River which is not typical of a river ecosystem and thus the unanticipated negative consequences to the overall health of the ecosystem. Dr Garcia notes that in the proponents own limnology report states that there will be “periods of more intense mixing that bring the sediment release material into the surface waters” (Appendix V 2.3)

Dr Vietz⁵ also reiterated that his greatest concern of the EIS proposal is the passing of water flow through the mine pit lake which potentially contains acid sulfate soils. He adds that “redirection of the McArthur River through the mine tailings could impact on bedload sediment transport conveyance from the McArthur River upstream of the mine pit lake to downstream of the mine pit lake” and that this effect has not been investigated in the current EIS. He suggests that to avoid the risks associated with the McArthur River being diverted back through the mine pit lake that an obvious alternative is to not connect the pit mine lake and adequately size the existing diversion channel.

It is of concern that the proponent favours a configuration that will eventually permit exchange of pit lake water to the river. The latest report from the MRM Independent

⁴ Dr Erica Garcia, May 9th 2017, A limnological assessment of McArthur River Mine Overburden Management Project Environmental Impact Statement pages 1-2

⁵ Dr Geoff Vietz, April 2017, McArthur River Mine Overburden Management Project, Expert Opinion pages 2-3

Monitor⁶ reflects on closure planning, and warns of the possibility of ultimate pit lake acidification. We believe that addressing this concern by redirecting the McArthur River through the mine pit lake will not meet the closure objective of leaving the site in a condition that is safe and secure for humans and animals. We note the identified risk in this current EIS for the potential entry of the (relatively large) Largetooth Sawfish into the lake which “could result in mortality of this threatened species if the environment present is unsuitable.” There appears to be a deliberate plan to manage ongoing contamination hazard at the decommissioned pit by transporting pollutants to sea - contrary to conditions of the mineral leases.

Given the concerns of Dr’s Garcia and Vietz, the MRM Independent Monitor and community concerns we make the following recommendation:

Reject the plan to redirect the McArthur River through a mine pit lake and reconsider complete backfill scenario as detailed below.

Chapter 4 – Decommissioning, Rehabilitation and Closure

Noting the proposed configuration seems designed to send contaminants offsite, we are concerned that the stated closure objectives in regards to water seem limited to beyond the lease boundary for the first century and then only within the McArthur River thereafter. As well as representing valid targets, on-site ground water monitoring will be a fundamental tool for understanding balance of the system as a whole, and transport of contaminants around and off the site.

Recommendation: closure objectives should also include quantitative targets for on-site surface and groundwater

On the little available information regarding so-called ‘legacy regions’, these would appear to be sacrificed zones, that will require ongoing maintenance of fencing and signage.

Recommendation: provide more detail regarding legacy regions

The draft identifies plans to revegetate “with native woodland and pasture species”. This could be interpreted as non-native pasture species which are often weedy, and consequently incompatible for disturbed regions. All non-native plants must be seen as weeds and extinguished from the site. Cattle can graze healthily upon native grasses but exotic ones have impacts on biodiversity that are untenable. Experience with slower than

⁶ *Independent Monitor ENVIRONMENTAL PERFORMANCE ANNUAL REPORT 2015*, McArthur River Mine, August 2016 Accessed from https://dpir.nt.gov.au/__data/assets/pdf_file/0008/384983/independent-monitor-environmental-performance-ar2015.PDF

anticipated success at revegetating the diversion channels from the first stage expansion should inform the approach to revegetation.

Recommendation: clarify stated revegetation plans

The mine pit lake configuration and timeline need further risk assessment for the likelihood of poor wet seasons. This and other features need to be risk-assessed in the context of anticipated variability due to global climate change.

Recommendation: contingency planning for pit lake management in event of dry wet seasons

Experience on other NT rehabilitation projects suggests weed management needs to be concerted and cannot simply be completed in a few years.

Recommendation: appropriate planning for sustained weed management operations

There is a potential that adverse environmental effects may take some time to bioaccumulate and so caution is warranted when reassessing the need to continue monitoring of fauna.

Recommendation: appropriate planning for sustained fauna monitoring

Chapter 5 – Project Alternatives

In this section, we are told (5.5.2.1.2)

“The sequencing and scheduling of mining activities has been refined via mine optimisation modelling”

Noting that environmental performance since the 2012 approval has been far worse than predicted, ECNT recommend that it is time to concentrate on optimising for rehabilitation outcomes rather than mining outcomes.

ECNT welcome the proposal to remove, rather than terra-form, the TSF. In our comments to the previous assessment in 2012, ECNT recommended depositing tailings to the void for closure. We welcome this late recognition of this requirement, but suggest this conclusion could have been reached sooner, without the implication that this preferable configuration should be made dependent upon a further extension to the life of mine.

We applaud contingency planning around early closure. But there is a lack of contingency planning for possible risks during continued mining. While it is not our wished for outcome, to fully inform assessment of the option of extended operations, Glencore should discuss contingency plans for the possible catastrophic failure of the TSF.

DME, in their response to the 2016 IM report, acknowledged:

“The most significant risk from current operations relates to the operation of the TSF”

ECNT welcome recognition that tailings should not be simply capped, but must be returned to the mine pit. This was a recommendation we made in the previous (2012) assessment. Our recommendation was made as a matter of urgency, not just for the long term management of tailings post-mining, but in response to the poor performance of the TSF cell 1.

Recommendation: The proponent should fully describe the benefits of immediate processing of tailings and deposition to the mine pit.

Project vs no project

Despite the statement’s claim, the ‘no project’ scenario should not be interpreted as “*early closure*”. This EIS process is in response to a Notice of Intent to *extend* the life of operations, yet again. Glencore’s claim that successful rehabilitation is reliant on yet another expansion is alarming. Why did the most recent approval, and subsequent regulation, not ensure that rehabilitation can be achieved within the current context? How might Territorians find any faith that this fundamental objective will be met this time, if it has been ignored to date?

It is particularly jarring that Glencore claim:

“The closure of the NOEF is to be managed, in part, by the development of the future NOEF ... Early closure would limit the opportunities for implementation of these proposals.”

ECNT warned in 2012, in response to the draft statement for the last expansion, that further studies to confirm characterisation of the overburden material should be completed before any approval was granted. We identified this as:

“fundamental data that should be informing the assessment process - particularly given that less stringent management requirements are being set for NAF material.”

Our recommendation was based on expert advice given to the operator by the (former) Independent Monitor, who cautioned that a much higher proportion of overburden was potentially acid forming, rather than benign. The Independent Monitor identified that some material, while generating a neutral leachate, gave high sulfate and metals, warning that:

“the acidity from metal sulfide oxidation precedes the dissolution of the neutralising carbonate. There is also the potential for bypassing of the neutralising mineralogy.”

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It is disturbing that Glencore now argue that a further extension of operations must be approved in order for them to adequately address the serious impacts of their wilful miscalculation.

Glencore's assessment of the impacts of a no-go option demand scrutiny and tolerate little doubt. The claim is made that their operation is:

"managed and regulated within a well-developed regulatory system, providing stringent controls on environmental and socio-economic performance"

ECNT strenuously reject this claim, and cite the numerous unprosecuted (but nonetheless documented) breaches of their environmental requirements.

Glencore warn that if this deposit is not fully exploited, other mines would fill the market need, that *"potentially located in a less regulated environment"*. We question how much less regulation Glencore might imagine than a sustained refusal to prosecute recurring breaches of the terms of their authorisation. The suggestion that *"this may lead to less favourable environmental outcomes"* is dismal.

The proponent claims DPIR would prioritise access and non-contamination of the remaining resource over prompt rehabilitation, if the new project were not to proceed.

It is true that, given the deteriorating state of infrastructure that has proven inadequate to manage the wastes now loaded, a so-called 'long-term care and maintenance' holding pattern would guarantee ramping environmental harm to surrounding land and water.

ECNT are interested in testing whether DPIR maintain policy that is consistent with the proponent's claim :

"It is unlikely, considering Government positions on resource stewardship, that substantial quantities of fill would be placed in the open cut final void with a significant resource remaining within the deposit."

If indeed such a policy exists, it is imperative that we revisit it promptly, to avoid being blackmailed in this way by a rogue operator ever again. It would be preferable for the resources industry to understand that a future NT Government will weigh more heavily concerns of environmental stewardship than those of comprehensive exploitation of a resource.

ECNT contend that inadequate consideration has been granted this option

Recommendation: the proponent should demonstrate a full appraisal of the benefits of ceasing mining operations at McArthur River.

Discussion of small scale vs large scale underground mining (5.5.2.1.1) underscores the fact that this project has enjoyed - and seeks to continue – a relationship with regulators that rewards staggered applications with piecemeal approvals. What is now described as ‘early closure’ was, in previous applications, a proposed expansion. Despite clear provision in the EPBC referral process for identifying proposals that would better be understood as a component of a larger action, this proponent has successfully gamed NT and Federal assessment processes to gain successive approvals for a staged development which now presents a far more significant environmental hazard and legacy than initial assessments ever considered. It is highly unlikely that any new mining hopeful who presented plans for a comparable operation, requiring active management for a thousand years, would ever move beyond an initial draft.

ECNT have previously described in a number of forums the risks of piecemeal assessment; that significant harms which may fall through the cracks between each approval, and that cumulative impacts of successive approvals may not get the scrutiny their combined impact should demand. In this project, we see a further flaw of piecemeal assessment: that one inadequately scoped and enforced authorisation can then be perversely presented as justification for a giving the operator more years.

Alternative 7 – Complete Backfill of Final Void

ECNT see value in keeping the final landforms as low as possible, given that

“the most prominent habitat feature within the MRM leases is the large sandstone plateau, the Bukalara Range, (which) stands 30 m to 100 m above the surrounding plains” [9.3.1.1]

ECNT are interested in further exploration of those options (7 and 8) that would backfill overburden to the pit. While it is apparent that handling of the overburden material would present environmental management challenges during decommissioning works, these options appear to offer a number of long term environmental benefits that have not been thoroughly considered in this EIS.

In reviewing the option of complete backfill provided in this EIS, Gavin Mudd⁷ highlights the inadequacies of figure 5.10 and the lack of consideration given to the safe emplacement of tailings and PAF wastes into lower section of the mine pit. Critical information regarding historical waste placement, characteristics and volumes is missing from this EIS to enable possible engineering approaches to mitigate leaching risks from wastes in the upper zones. This alternative has not been adequately considered including providing detailed

⁷ Assoc. Prof. Gavin M. Mudd, May 2017, *McArthur River Mine Overburden Management Project – Draft Environmental Impact Statement*. page 5.



hydrological assessments, acknowledgment that risks can be mitigated and fails to make a strong case that this option should be rejected.

Gavin Mudd further highlights the distorted and bias comparison in reference to Table 5.4, he states the table “appears to be somewhat subjective, is heavily focussed on financial aspects – with 8 of the 12 key aspects relating to financial costs (i.e. constructability, financial cost, maintenance ease). This effectively biases the outcome towards avoiding a higher cost approach that delivers better environmental and social outcomes, which is where the primary focus should be”. We lament that Glencore is very quick to say that this option will render the project uneconomic and unviable. As Mudd⁸ points out the NT Rum Jungle Mine first rejected the proposal to backfill waste rock on cost grounds. Now after failure of the above ground rehabilitation works, the project is committed to back fill at the expense of this NT community. Does rejecting this alternative option at this point effectively transfer the cost of safe and secure rehabilitation to future generations? The public have little detail to go on regarding the costs of rehabilitation, and the miner’s capacity and willingness to meet those costs in the short or long term.

We adopted Mudd’s recommendation:

The EIS Response Document must include a realistic complete backfill scenario which ensures all PAF material is sequenced as deep as possible in the former pit. As part of the process, the broader Borroloola community must be engaged meaningfully in ascertaining their preferences for complete pit backfill – with a multi-criteria analysis or approach which properly allows for their social and environmental preferences to be included as equalweight to financial or economic considerations (i.e. cost alone should not dominate rejection of the complete backfill scenario).

The following scientific opinions add weight to our concerns for this project as it has been presented by Glencore. We urge you to read the reports that we have submitted in their entirety as our summaries are unable to do them justice.

Chapter 8 - Water Resources, ground and surface (inc Appendix T & N)

Upon reading the comments from Abbas El-Zein⁹ we support his serious concerns regarding ‘both the approach taken to protect water from contaminants and the quality of predictions from the numerical modelling of groundwater contamination by heavy metals’.

⁸ Ibid, page 6.

⁹ Abbas El-Zein, *Environmental Impact Statement on the Expansion of the McArthur River Mine*, May 2017



His first concern is that the project assessment appears to rely on sorption as the primary means by which heavy metals are prevented from polluting surface waters downstream without consideration of competition, non-linearity and pH sensitivity. The evidence provided in the EIS may not be a “scientifically valid assessment of the extent of attenuation of heavy metal contamination as sorption needs to be determined for the specific geology of the MacArthur River region while considering competition between contaminants for sorption sites, non-linear sorption conditions, sensitivity to soil pH and desorption”¹⁰

He goes on to say “judging by the EIS, the reliance on sorption for protection of surface waters downstream of the mine has not been adequately supported by the evidence provided in the EIS and carries therefore significant risks. If sorption has been overestimated, the actual concentrations of heavy metals may be orders of magnitude larger than those predicted in the EIS and may travel manyfold further than estimated in that document”. This needs to be addressed in the EIS response document.

El-Zein¹¹ also asserts that detailed designs of the base lining for the NOEF need to be provided. “Absence or inadequate design of this feature would be against best practice and may lead to contamination at the receptors”

El-Zein’s¹² assessment also address concerns related to low confidence in contaminant transport model provided and asserts that “more detailed information about the contaminant transport model is required for a proper assessment of the risk to receptor”. This is a significant issue as “the numerical model is the single most important piece of evidence on which the EIS bases its argument that the mine’s activities, as planned, can be conducted while achieving the environmental standards required. Therefore, significant weaknesses in the model raise serious concerns about the future risks to water quality”.

Lastly El-Zein questions whether molecular diffusion needs to be considered given that “the EIS stated aim to provide protection for ground and surface water for up to 100 years and then and up to 1000 years, and given that many parts of the geology around, and downstream from, the site have low to very low hydraulic conductivities”. This is significant because “if diffusion turns out to be significant in parts of the geology, concentration of contaminants at the source may be higher than what is predicted by the EIS report and the contamination plume would travel further than what is shown in Figures 154 to 162”.

Recommendation: The EIS Response Document needs to respond to all of Professor El-Zeins concerns and refer to his detailed comments on the EIS for further understanding of the important issues he raises.

¹⁰ Ibid, page 3.

¹¹ Ibid page 4.

¹² Ibid page 5.

We also support the following recommendations from Gavin Mudd concerning water resources¹³

The discrepancy in using SILO versus onsite climate data should be explicitly justified, as there appears to be a potentially significant inconsistency in annual rainfall values – these are critical in ensuring the accuracy of all hydrological models used for the EIS.

The EIS Response Document must outline methods to identify the extent of groundwater contamination across the MRM site and propose plans for its remediation before or during rehabilitation and site closure to ensure that environmental and cultural values are maintained. The groundwater monitoring plan should include bores downstream of the diversion channel (e.g. on the far right of Figure 8-53).

The EIS Response Document must include proposals to distinguish possible mine-related impacts on the surface water quality of the McArthur River. Such methods must allow the neutral identification of the source from the MRM site, and provide scope for warning before the impacts are severe.

Again we urge you to seek further understanding directly from his comments.

Appendix N – Geotechnical Assessment

Information detailed here is provided by Professor David Airey¹⁴ in his comments for the Draft EIS

Airey states that “a thorough analysis of the NOEF stability is presented using appropriate methodology. However, any analysis is only as good as the input parameters and this is where I have some concerns”. In the case where no original data has been provided in the EIS “it is thus impossible to assess the methodology used to perform the tests or the methods of interpretation. In my experience, based on reviewing test reports, simply performing Australian standard tests does not guarantee the quality of the data. They need to be carefully reviewed by experienced geotechnical engineers who have a thorough understanding of soil mechanics”. His biggest concern relates to “Figure 13 in Appendix N. This shows a plot of peak friction angle against “cohesion”. The first and most critical issue with this is that most clays do not have any true cohesion”. He goes on to say ‘the reason why this is critical is that the stability of the steeper part of the slope of the NOEF relies on the “apparent” cohesion (c’). It can be shown by a simple infinite slope analysis with a failure plane running along the CCL layer that the factor of safety increase from 1 to 1.5 is due to the apparent cohesion. If the cohesion is assumed to be zero the factor of safety will be one, that is the CCL will be on the verge of failure, and this would represent an

¹³ Assoc. Prof. Gavin M. Mudd, May 2017, *McArthur River Mine Overburden Management Project – Draft Environmental Impact Statement*. page 7-8.

¹⁴ Professor David Airey, *Report on the Draft EIS of the Overburden Management Project*, May 2017

unacceptable risk on any critical slope. To understand the basis for the “apparent” cohesion more information is required”.

Professor Airey continues to raise concerns regarding friction angles, cohesion, pore pressures and water retention curves. This is admittedly beyond our technical understanding but we are clear that he raises very valid concerns that need to be fully addressed in the EIS response.

Recommendation: The EIS Response Document needs to respond to all of Professor Airey’s concerns and refer to his detailed comments on the EIS for further understanding of the important issues he raises.

Chapter 12 - Social Economic Environment

Perhaps the most significant economic benefit from this project to the NT comes from employment. The employment figures as displayed in Appendix Z may be misunderstood by the presentation of totals. Unlike revenue, employment does not accrue; if and when we enable jobs for the second stage of the project, we no longer have the jobs from the previous stage.

Section 6.2.2 of Appendix Z claims that NT royalties are directly related to production levels: this has not been the evidence over most of the life of the mine. The NT has no control over what profit Glencore pays royalties on, irrespective of the volume of production.

While the short term and immediate economic benefit of extended operation are well described, neither the Economic Impact Assessment nor the chapter on socio economic environment adequately address the nature of transition to a post-mining economy. ECNT welcome the recognition of Gurdanji ambitions for ongoing employment in the closure and monitoring phases of the project through a Gurdanji Rangers Unit. It is likely that various actions from the community benefit fund will contribute to building the local economy as operations at the mine scale down, but insufficient detail is provided. We are not well equipped to evaluate the economic benefit post-mining of the various project alternatives.

Recommendation: describe in more detail how the economic benefit from extended operations can contribute to a smooth transition to a post-mining economy.

Final comments - Long term monitoring

We support and adopt Associate Professor Gavin Mudd's¹⁵ recommendations regarding long term monitoring and his request for detail financials for project funding for one thousand years. This is required to give confidence and certainty that it will not be the tax-payers left to fund a safe and secure rehabilitation. Guarantees need to be given that the present and future generations of the Borroloola community will not be left living in a perpetually poisoned environment.

The EIS Response Document must present a detailed approach for assessing surface water quality and how to identify potential mine related impacts.

The EIS Response Document must present a detailed financial approach for ensuring that funding for the next one thousand years will be secured by the MRM project and not left to tax-payers to fund.

Appendices:

The following reports have been emailed with our submission and form a part of our Appendices (in order of appearance in our submission)

Assoc. Prof. Gavin M. Mudd, May 2017, *McArthur River Mine Overburden Management Project – Draft Environmental Impact Statement*

Dr Erica Garcia, May 9th 2017, A limnological assessment of McArthur River Mine Overburden Management Project Environmental Impact Statement

Dr Geoff Vietz, April 2017, McArthur River Mine Overburden Management Project, Expert Opinion

Abbas El-Zein, *Environmental Impact Statement on the Expansion of the McArthur River Mine*, May 2017

Professor David Airy, *Report on the Draft EIS of the Overburden Management Project*, May 2017

¹⁵ Assoc. Prof. Gavin M. Mudd, May 2017, *McArthur River Mine Overburden Management Project – Draft Environmental Impact Statement*. page 8.



**NORTHERN
LAND COUNCIL**

Our Land, Our Sea, Our Life

GPO Box 1222 Darwin NT 0801
45 Mitchell Street Darwin NT 0800
P: 08 8920 5100 • F: 08 8945 2633
Freecall: 1800 645 299
www.nlc.org.au
ABN 56 327 515 336

17 May 2017

Ref: MNT2014/0018

Mr Rod Johnson
NT Environment Protection Agency
GPO Box 3675
Darwin NT 0801

By email: eia.ntepa@nt.gov.au

Dear Mr Johnson

DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE MCARTHUR RIVER MINE – OVERBURDEN MANAGEMENT PROJECT

We thank you for the opportunity to submit comments to the Draft Environmental Impact Statement for the McArthur River Mine – Overburden Management Project (the “Project”). Officers of the Northern Land Council (NLC) have examined the document and have prepared a submission, which is attached.

The NLC advocates that further research be undertaken to ensure that all risks associated with the Project are captured in the EIS and provide maximum protection to the environment of the region. The NLC submission draws attention to the following issues that are considered to be of particular significance to local Aboriginal people and the NLC:

- Proposed management of reactive waste material and spontaneous combustion;
- Stakeholder consultation;
- Competence of both the mine operator and regulator; and
- General comments about deficiencies relating to the EIA process in the Northern Territory

These issues and other concerns are further described in the NLC’s submission. Should you have any queries regarding our comments, please do not hesitate to contact Rhonda Yates on 8920 5241 or via email sarmar@nlc.org.au.

Yours sincerely

Joe Morrison
CHIEF EXECUTIVE OFFICER

Katherine	Jabiru	Nhulunbuy	Borroloola	Ngukurr	Tennant Creek	Timber Creek	Wadeye
P.O. Box 396 Katherine NT 0851 P: (08) 8971 9899 F: (08) 8972 2190	P.O. Box 18 Jabiru NT 0886 P: (08) 8938 3000 F: (08) 8979 2650	P.O. Box 820 Nhulunbuy NT 0881 P: (08) 8986 8500 F: (08) 8987 1334	P.O. Box 453 Borroloola NT 0854 P: (08) 8975 8848 F: (08) 8975 8745	P.M.B. 85 via Katherine NT 0851 P: (08) 8975 4755 F: (08) 8975 4601	P.O. Box 55 Tennant Creek NT 0861 P: (08) 8962 1884 F: (08) 8962 1636	43 Wilson St Timber Creek NT 0852 P: (08) 8975 0789 F: (08) 8975 0664	Lot 788 Kanarlida St Wadeye NT 0822 P: 0439 830 435

Draft Environmental Impact Statement for the McArthur River Mine Overburden Management Project

Northern Land Council Submission to the
Northern Territory Environment Protection Authority



17 May 2017

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ATTACHMENTS

1. Cultural Heritage, Socio-Economic Environment and Consultation Processes
2. Issues Related to Spontaneous Combustion

1 Introduction

The Draft Environmental Impact Statement for the McArthur River Mine Overburden Management Project (the EIS) is an extraordinary document about a singular development with a remarkable history: the world's largest zinc/lead extraction and processing operation as overseen by Australia's weakest political jurisdiction.

On the one hand, the EIS seeks “closure” by setting targets for ending mining operations and constructing a new post-mining landscape. On the other, by formally proposing a 1000-year timeline for observing and intervening in that landscape's evolution, this proposal shows that there will be no end to the uncertainty created for the Aboriginal owners and other users of the mid-to lower McArthur River catchment and its adjoining seas.

The Northern Land Council (NLC) provides support to the Top End (Default PBC/CLA) Aboriginal Corporation, which is the registered native title body corporate in respect of native title determination over the area of land covering McArthur River Station, on which the mine is located (**Native Title Determination**). The *Aboriginal Land Rights (Northern Territory) Act 1976* also requires the NLC to “assist Aboriginals in the taking of measures likely to assist in the protection of sacred sites on land (whether or not Aboriginal land) in the area of the Land Council”.

Mineral leases granted under the *McArthur River Project Agreement Ratification Act 1992 (NT)* expire in January 2018, but the relevant Minister is required to renew them for a further 25 years, ending in 2043. On expiry of the leases then, or somewhat later when the mining stops (which is currently proposed for 2048), the native title rights over the site will have full effect. Native title holders will have rights to, for example, conduct cultural activities, take and use the natural waters and other natural resources. The condition of the land and its resources - hence the on-site and wider effects of the mine - are of critical interest to native title holders and other Aboriginal land owners and residents in the region.

The NLC is obliged to do all it can to ensure that those rights and interests are not compromised. The focus of this submission is therefore on those aspects of the proposal that are considered most likely to affect the long term interests of the native title holders and other Aboriginal people. These encompass present and future operations and approaches to closure.

2 Understanding of the proposal

The proposal under consideration differs from operations already approved after previous EIS in that it incorporates:

- extending the commercial operational life of the mine to 2047;
- re-designing the principal overburden dump to a smaller footprint but taller profile with consequently steeper slopes, enabled in part by placing some overburden in worked out sections of the open pit late in mine life;
- new processes for categorising and handling waste rock, including highly reactive material;
- when extraction of ore from the pit is nearly complete, reprocessing tailings to extract additional saleable product (lead-zinc concentrate): running from about 2037 to 2047;

- placement of reprocessed tailings in the pit, and decommissioning and rehabilitation of the tailings storage area when all tailings have been removed (about 2045-2048);
- completion of construction of a single waste rock dump encompassing the existing northern overburden emplacement facility (NOEF), its covers and associated drainage and monitoring systems prior to mine closure (progressively from 2018-2031);
- active filling of the open cut pit with water to minimise length of exposure of reactive material (2048-2052);
- reconnecting the natural McArthur River channel with the pit (first downstream and then upstream) if pit water quality permits, so that the river flows again but through the open pit “lake” (tentatively 2062 for downstream and 2072 upstream connection);
- new rehabilitation objectives for the site and its offsite impacts; and
- processes and timelines for monitoring and responding to performance in meeting those objectives, including:
 - a period (of “adaptive management” of the site during which adjustments and structures and processes might be made to improve performance (from 2047 for about 70 years);
 - another longer period of “proactive monitoring” to check whether performance meets targets (from about 2120 to 2200); and
 - a subsequent “reactive monitoring” phase that would continue indefinitely during which the site would be checked when there was reason to anticipate disturbance (i.e. extreme weather, earthquake, etc.) that might compromise structures (from 2200 nominally to 3037).

Because methods of extraction and processing and total volume of ore mined and rate of mining do not differ greatly from existing approvals, the EIS does not cover mining, processing or haulage operations.

3 Approach to analysis and commentary

As noted above, our concerns relate primarily to issues with the most direct and enduring impact on Aboriginal connections to lands and capacity to safely use waters and other resources for customary, recreational and commercial purposes. We have therefore focused on understanding the implications of proposals for waste rock handling and tailings disposal, which have the potential to contaminate surface and groundwaters over the very long term and use of the open cut pit on completion of ore extraction, which will become a permanent and problematic feature of the landscape. We also offer some additional comments on less central but still significant matters of concern.

The comments and recommendations specific to the Project will therefore emphasise:

- (1) treatment of Aboriginal and other local interests in setting objectives, especially in regard to post-mining (rehabilitation) targets;
- (2) difficulties with the existing overburden emplacement facilities (OEF), especially the new NOEF;
- (3) design of the NOEF, including its incorporation of the existing structure;

- (4) proposals for in-pit disposal of reactive overburden and tailings; and
- (5) use of the open cut pit and its connection to the river-scape.

We will also offer comment on issues raised by this Project and its history, but which also have wider relevance, including:

- (6) weaknesses in the Environmental Impact Assessment (EIA) process and the regulator's capacity to set meaningful conditions;
- (7) capability and commitment of both operator and regulator to manage the process and ensure conditions are met; and
- (8) transfer of risks and costs to landholders, residents, resource users and other members of the general public.

Where references are made to particular statements cited from the EIS, page numbers are prefixed by chapter or appendix identifier (e.g. 3-10 and A-10 refer to page 10 of Chapter 3 and Appendix A respectively). Other references are provided in full in the endnotes.

4 Consideration of issues

The comments are based on input from Aboriginal people with connections to the affected region, and NLC staff. And although we have chosen to use the themes outlined above to present our submission, some additional matters of concern are raised in recommendations.

Due to the large amount of information provided in the EIS, its highly technical nature, its presentation, and the limited time given to respond, we expect to seek and receive additional input as awareness of the proposal grows and relevant people have more time to consider its implications. More matters may be raised with the NTEPA and government as the process unfolds.

4.1 Aboriginal interests and environmental objectives

This EIS is unusual in setting very long term closure objectives (page 3-41). The form and content of those objectives and the way they were arrived at says a good deal about the proponent's view of Aboriginal landowners, their communities and their place in the Territory.

The core goals set out by the proponent are to leave the post-mining landscape "safe and secure" in the short term (100 years) and "safe" for the long term (1000 years). In going beyond these vague terms, emphasis is placed on geotechnical, erosional and geochemical stability and on monitoring these features at the mine site.

Stability is an obvious requirement for safe and usable landscapes but it is remarkable that this term should be used to describe a situation that will require active intervention in perpetuity. For example, maintaining geochemical stability on site will require the regular removal of contaminated sediments and water from various sumps, trenches and natural drainage lines for disposal into the pit or directly into the river. Achieving local stability in the ways proposed under the EIS will, as raised later in this submission, create risks of destabilising areas outside the mine site and will themselves be unstable because they are dependent on undisclosed governance and financial arrangements.

Security can be defined as freedom from danger or threat. It is an essential pre-requisite for people to maintain customary and other relationships with land and waters. They must be free

to use animal and plant resources without fear that they have been adversely changed. From this perspective, priorities for the region's Aboriginal people, including native title holders and sacred site custodians might be expected to place special emphasis on the health of the region's natural resources and the integrity of sites of significance in their cultural and landscape settings. However, there is no way of determining from the EIS what relevant Aboriginal people actually think, because the consultation process and the manner in which it is reported are flawed.

These problems are set out in detail in Attachment 1, and can be summarised as:

- In the NLC's opinion inappropriate identification of people with the authority and knowledge to speak for relevant country on matters affecting its management and condition;
- many individuals identified as traditional owners who, in the NLC's opinion, are not traditional owners of the area within the mineral leases;
- failure by the proponent to identify, in NLC's opinion, the correct people as traditional owners people of the area covered by the mineral leases, including areas on which the expanded NOEF is to be sited;
- no information by the proponent on how it identifies "custodians";
- failure to engage with relevant organisations, including the NLC, who have the statutory roles and knowledge, to identify the correct people;
- despite recognition of the risks involved in consulting the wrong people, failure to manage the process to avoid these risks, risks which also include subsequent conflict;
- failure to observe leading practice for consultation and public participation in the assessment, despite readily accessible expertise and industry and other guidance on these issues^{i,ii};
- failure to satisfy the requirements of the EIS' terms of reference relating to objectivity; and
- no evidence that key environmental and other risks from operations and closure objectives and the proposed management of these risks were properly communicated to the correct people in an objective manner and that people had the opportunity to seek independent advice.;

For these reasons, the NLC is not satisfied that the correct people, particularly custodians, have been identified and consulted or that consultations were conducted properly. In our view, consultations need to be undertaken with the relevant custodians, not just by the representatives of the proponent, where such consultations are unlikely to be on arm's length terms, but rather with custodians being afforded the opportunity to obtain independent advice which is especially important in light of the long-term impact of the proposal.

4.2 Retention of the existing NOEF

The existing NOEF was poorly constructed in a manner which apparently did not accord with conditions of approval for Phase 3 (page 3-110). There appears to have been no effort to construct a continuous, uniformly impermeable base using benign materials (suitable clays) available on site. Although the existing facility appears to be naturally underlain by alluvial clay over much of its area, it is also intersected by stream channels (page 3-175 and elsewhere) filled with highly permeable alluvium (sands and gravels; page 6-73), creating a

number of competent pathways for seepage entry to groundwaters. This problem is exacerbated by construction at or below 2013/14 groundwater levels¹ (the level at which the new NOEF will be built). Modelling suggests that groundwater will be at or higher than these levels at least one year in 12 (page 3-115), posing a significant risk to the integrity of the base.

Compounding these fundamental errors, the emplaced overburden was not well segregated and salinity-generating and acid-forming materials were mixed with benign materials in many parts of the structure (page 3-109). Some highly reactive material was placed outside the cell intended to accommodate potentially-acid forming (PAF(RE)) overburden. Reactions continue at significant rates in a number of locations, evidenced by “hotspots” revealed in drilling programs (page H.52 and elsewhere).

Given the state of the existing NOEF, oxidation products from both the PAF cell and improperly-placed material may currently be entering groundwaters in substantial quantities. Even if encapsulation is successful in slowing reactions, the vadose zone will likely intersect improperly placed non-benign (and often oxidised) materials with some frequency to exacerbate contamination of seepage, including mobilisation of metals. If the material is not removed to permit construction of a functional low permeability base, then seepage rate targets set for other parts of the (expanded) overburden facility cannot be met and groundwater and surface water pollution will be greater than would otherwise be achievable: and these problems will continue indefinitely.

MRM has categorically rejected the option to replace or reconfigure the existing NOEF (page 3-104). Indeed the company has implied that a requirement to do so may put at risk the continuation of mining (page 7-27), community benefits (page 7-18) and quality of rehabilitation (pages 7-29, 7-30).

Nonetheless, it is the NLC's considered view that the flaws in the existing NOEF will not be sufficiently ameliorated by incorporation in a larger structure, because problems with the base are not addressed. In our view there could be no clearer obligation than to correct past mistakes. Yet the response presented is to cover it up and require local people to accept the consequences.

4.3 Design of new Overburden Emplacement Facilities

Having completed important work on materials classification to better segregate and store problematic overburden, MRM proposes an improved design of new parts of the main waste rock dump, the NOEF, including a constructed low permeability base, cells for reactive material divided by low permeability advection layers, a halo of relatively benign material, and a low permeability cover over upper surface and sides to limit both infiltration of water and movement of gases (pages 3-110 to 3-120). Steps are also proposed to improve operational performance in selectively handling and placing overburden within facilities (pages 6-67 and 6-68).

The design also differs in storing more material on a smaller footprint, requiring a much taller structure with steeper sides. In addition to concerns about the decision to incorporate an existing flawed structure in the existing NOEF, the revised design also raises a number of additional issues for Aboriginal interests.

¹ Appendix H (NOEF Historical Construction and Drilling Report) does not give elevation relative to groundwaters, but it appears reasonable to assume that the new NOEF would be built no lower than the existing level.

4.3.1 Height

At the request of custodians of the nearby Barramundi Dreaming sacred site, the NOEF height is presently restricted to 80 metres. At 140 metres, the redesigned structure will be 60 metres higher than the previous design. MRM stated that they have obtained the written consent of relevant traditional owners (page 12-43). However, as noted in Section 4.1, there is a lack of information about the process which MRM adopts to identify the custodians. There is also no information as to the consultation process involved with the custodians and whether the custodians were afforded the opportunity to obtain independent advice about the agreement as any advice provided by MRM about the impact of the agreement would not be independent and objective.

4.3.2 Stability and durability

There are also serious concerns about the physical stability of such a structure that is apparently expected to remain in place for at least 1000 years.

Sides will be trilinear concave, being steepest at the top (1v:2.5h) and shallowest at the foot (1v:4.5h). The EIS acknowledges that construction at these angles with available mine machinery will be challenging (page 3-131), especially given the importance of flawless continuity of impermeable covers extending down the sides to the base. Irrespective of the quality of construction, erosion and slippage is inevitable. The EIS also acknowledges that regular repairs will be essential (e.g. J-67 to J-71), which will be especially challenging after cessation of mining given the likely absence of appropriate machinery. Stability may also be compromised if oxidation of reactive components of the core continue, including the risk of spontaneous combustion that would lead to slumping. Risks are increased by the decision to retain the existing NOEF in its present “contaminated” form.

It therefore appears questionable to apply the **minimum** Factor of Safety for tailings dams (page 3-151) in an environment where: parts of the base will be regularly exposed to groundwater over somewhat heterogeneous natural sediments (particularly in the case of the existing NOEF: see Section 4.2 above); extreme rainfall events are common and recurring erosion is therefore inevitable; and exposure of the base to external flooding from the McArthur River, Surprise Creek and Barney Creek is likely during the period covered by the EIS (noting that flood protection measures are designed to cope with 1 in 100 year events - page U-250 and elsewhere).

It is relevant that in documents prepared for the Phase 3 EISⁱⁱⁱ, stability benefits of shallower slopes were emphasised, with 1:4 slopes regarded as providing an adequate Factor of Safety. It was noted that rock that may initially be relatively stable at the angle of repose may need cutting back to a 1:4 slope to enable erosion protection if it became more friable with weathering.

The NLC has serious concerns about risks of catastrophic and/or progressive failure of the proposed structure. Obviously, well-designed facilities for safe handling and storage of reactive overburden will be required throughout mine life and the proposed siting of the bulk of the overburden may be reasonable during operations. However, we consider that a decision to leave a large and inherently unstable waste rock dump on an active floodplain transfers too much risk and ongoing liability to local Aboriginal people and the Territory public in general. The manner in which necessary levels of expensive repair and other intervention could be guaranteed indefinitely is unclear and is likely to remain uncertain. Local resources are already stretched in coping with other mining legacies^{iv,v,vi}.

4.3.3 Cover and advection barriers

In options for NOEF design and construction, bituminous geomembrane was identified as a functionally superior alternative to compacted clay liners to both limit advection (oxygen reaching reactive material) and percolation of water (contributing to some reactions and mobilising oxidation products). In presenting results of a multi-criteria analysis for NOEF cover design, it is shown that the membrane scores best of all options considered, if it is assumed that it remains functional over the very long term. Initial costs would be offset by relative simplicity of repair (page U-65).

Its use was, however, rejected on the grounds that “further investigation and validation of installation methods, as-built performance, and longevity will be required before this alternative could be considered for large scale operational use” (page 3-130). Doubts about long term durability appear to have been decisive.

Given the risks of recurring failure of alluvium-based covers due to erosion and the other factors outlined above, capacity to make rapid repairs effective over timeframes relevant to the length of mine operations (prior to closure), appears to us an important advantage. As noted above we do not regard a “permanent” OEF on the floodplain as a serious option, irrespective of cover design. But given the problems experienced with overburden management to date, we would argue that improved capacity to rapidly and effectively limit oxygen and water entry to overburden facilities is essential, and the role of such membranes should be re-considered for this purpose.

4.3.4 Seepage

The effectiveness of compacted clay layers in limiting movement of gases depends strongly on their moisture content. The NOEF design emphasises a balance between sufficient percolation to maintain performance of advection barriers while avoiding excessive mobilisation of pollutants and their entry to groundwaters (S-83). This approach requires acceptance of ongoing interventions to capture and remove “toe” seepage through drainage layers built into the OEF and to intercept deeper seepage through trenches and vertical or horizontal bores (e.g. page 15-18). Barney Creek and Surprise Creeks become permanent drains for handling polluted groundwater expressed at the surface. Polluted waters will mostly be disposed of in the mine pit or flushed down the McArthur River at time of high flow, as permitted in the mine's Waste Discharge Licence (e.g. page 8-3).

We consider that every plausible measure should be taken to limit the total loads of pollutants entering the McArthur River, and argue that the proposed NOEF design unreasonably increases these loads. Much reliance is placed on the capacity of soils to neutralise acid products and bind metals before they reach the river, but information is not presented on how long this capacity can reasonably be expected to be maintained nor the extent to which competent pathways to both shallow and deeper groundwaters will emerge to evade neutralisation and absorption. We suggest re-examination of the potential for the levels of oxidation products that ultimately find their way into the McArthur River to be significantly reduced by use of bituminous membranes in life of mine waste rock dumps. The EIS notes that tightening of discharge criteria may compromise the ability to relinquish the site (page 4-12).

Irrespective of the trigger values for contaminants at the key monitoring point at SW11, there remains considerable uncertainty about their ultimate fates and the risks of accumulation in parts of the river and its catchment. Dumping contaminants in the river during high flow obviously dilutes them, but it also means that they will be delivered to the floodplain where

they may accumulate in depressions that lose water primarily by evaporation. Even within streams, slackwater areas tend to accumulate more metals^{vii}. There appears to be no consideration of this important issue.

Related concerns about unremediated pollution of deeper groundwaters are covered in Sections 4.4 and 4.5 below.

4.3.5 Spontaneous combustion

Work done to improve classification, recognition and segregation of highly reactive overburden will help reduce the risk of spontaneous combustion of sulphide-rich materials. Risks remain in the existing flawed NOEF (page 3-109), which is not to be reconfigured despite showing hotspots where oxidation rates continue to be high.

Additional risks will arise during construction and operation of new overburden arrangements, wherever they are located. For example, it is not clear whether the proposed 10 cm separating layer of compact alluvium (page 3-104) will isolate PAF layers enough to inhibit sustained and spreading reactions. Will reactions beginning in one layer - say as a result of exposure to moisture in un-seasonal rain events or unusually high humidity during handling - facilitate oxidation in others through heating and related convective and diffusive movement of gases through the layers of reactive material and the thin bands of benign material separating them? All alluvium to be used in PAF cell construction should be rigorously tested for suitability.

Thermal monitoring of the NOEF may allow MRM to identify areas where combustion events are occurring, but it will not be useful as a predictive management tool unless the temperature at which combustion commences is known. The EIS does not appear to present any direct evidence that its thermal imaging systems will be capable of detecting change early enough permit intervention before substantial SO₂ has been generated and is detectable by gas monitoring systems.

4.3.6 Dust

All overburden placement options, irrespective of levels of rehandling, raise serious issues in management of dust that led to elevated metal levels in sediment and fish in Barney Creek (page 1-21 and elsewhere). The Independent Monitor noted failures to report exceedances of soil and sediment criteria at a number of sites during 2015^{xiii}.

The principle treatment for dust suppression is watering (e.g. page 7-30), which is clearly inappropriate when handling non-benign waste rock which is most likely to produce bio-available metals. Problems are likely to be significant in all OEF areas. Ongoing and intensive mitigation measures such as sediment traps will be essential to avoid similar risks in all drainage lines within reach of dust plumes, but will not retrieve all metals deposited, which may accumulate in poorly drained depressions in the landscape.

The NLC views the entry of lead and other toxic metals to food chains as a most serious threat to the health of Aboriginal people who regularly consume animals at higher trophic levels that may accumulate metals at dangerous levels. These include goannas, turtles, file snakes and birds that consume small fish and that may move from the site of contamination. None of these have been examined for elevated lead or other relevant metals. It is essential that monitoring of lead in tissues extend beyond the obvious species like barramundi (pages W-16 to W-19) or plants that probably pose much lower risks.

4.4 Placement of tailings and/or overburden in open pit

The major change between the Phase 3 EIS and the overburden project is to dispose of mine waste, including some overburden, tailings and polluted ground- and surface waters into the mine pit, which would be filled with water.

4.4.1 Tailings

MRM intends to change arrangements for long-term management of tailings. When all accessible ore has been processed, tailing reprocessing to extract additional concentrate will begin (in 2037), with reprocessed waste going into the open pit (page 5-17). The Tailings Storage Facility will be decommissioned and rehabilitated, reducing or at least relocating one major long term source of contamination of ground and surface waters. Existing tailings will be moved to the mill for reprocessing as a slurry and waste pumped to the pit in the same form. In general, the NLC views this as a positive concept, but there remain some significant questions about the relative benefits and (environmental) costs of the methods proposed in the EIS to use the pit to store tailings or overburden or various combinations of both; and about the related condition of pit waters in the short to long term.

4.4.2 Overburden

Some highly reactive overburden extracted late in mine life is also to end up in the pit. Initially it will be stored in temporary PAF cells in the Eastern OEF, which is protected from flooding by placement within the mine pit levy (page 5-16). Seepage will be directed to the open cut.

However, the option to return all overburden to the pit has been rejected. The EIS describes this option (Alternative 7) as placement of “overburden inside the mine levee wall where the perception is it will have a lower risk of impact on the external environment” (page 5-29 to 5-32). It is argued that:

not all overburden can be accommodated below the natural surface level in the final void, due to the material swell factor in the order of 25-35%. Excess overburden would need to be placed in a specially constructed facility about 20 m in height constructed over the back-filled open cut final void, extending from the WOEF to the mine levee wall. Priority would be placed on returning potentially reactive overburden to the final void meaning that majority of the tailings will remain in a surface storage facility so as not to consume final void capacity for the replaced overburden.

Many reasons are given for this option being untenable (page 5-31), including:

- The existing and expanded NOEF core, encapsulated for up to 20 years, would be re-exposed, increasing oxidation rates and risking release of additional contaminants.
- The original contaminant load, plus the increased load, placed into the final void and overlying OEF and would require ongoing management. Oxidation products will include soluble contaminants with potential for bioaccumulation.
- Large scale water treatment would be required during the backfilling process to remove these contaminants from the water.
- Despite water treatment and barrier layers, oxidation products may have connections to the external receiving environment.

- Rainfall and surface water runoff accumulating inside the mine levee would not have an escape pathway. This water would either have to be pumped back out over the mine levee wall or left to infiltrate (e.g. via palaeochannels under the mine levee wall). Pumping would be required for the foreseeable future, while infiltration increased risk of the water becoming contaminated and entering the downstream environment.
- The mine levee would require perpetual maintenance.
- Undertaking another mining activity (NOEF back into open cut) will have impacts (e.g. dust and fuel consumption (with greenhouse gas emissions)).
- Re-exposure of overburden material risks spontaneous combustion generating sulphur dioxide, posing a health and safety risk.
- This option presents the greatest cost ... rendering the project uneconomic and unviable. No further operations would occur, with consequent cessation of employment and community investment projects, services, taxes and royalties.
- Tailings would remain in a capped facility in the present location.

A related option is to put the worst of the reactive overburden in the pit and to retain a smaller, lower profile waste rock facility north of the existing one, containing a significant amount of non-benign overburden (Alternative 8 pages 5-32 to 5-34). The highly reactive overburden placed in the pit would be topped with a layer of overburden with high neutralising capacity mixed with tailings to form a relatively impermeable layer. This would in turn be capped with a layer of compacted clay over which a layer of benign alluvium and rock would be placed. This layer would be at a depth about 16 m below the natural surface, ensuring that only benign materials would be in the alluvium stratum where most groundwater movements occur.

This option raises many of the same difficulties associated with the full return of overburden, as well as more complex overburden handling arrangements on a substantially larger footprint, including areas north of the present NOEF. The EIS also rates this option as commercially non-viable, and requiring that mining halt.

It is impossible for the external reviewer of this material to make judgements about the merits of these competing arguments and the proponent's selection of the preferred option, because none of the environmental costs of any of the options are quantified in ways that permit meaningful comparison, and claims about financial cost are not supported by any information at all. These difficulties are compounded by the fact that the bond available to repair existing damage and the conditions under which it can be accessed are unknown.

The discussion of options presented in the EIS is therefore most useful in revealing, beyond any reasonable doubt, the deep intractability of the severe environmental problems already created, which are likely to grow in scale with continued mining. All options are plagued by great uncertainty: and all require ongoing maintenance of artificial and potentially fragile structures and rigorous and expensive monitoring of their condition and contaminant products for a very long, but ultimately uncertain period of time. There is no unambiguously favourable response to the dismayingly difficult situation the operator and the regulator have created for the region's people and the Territory more broadly. We return to this issue in recommendations.

4.5 An open cut lake

The proposal to place tailings and some overburden in the pit and then fill it with water is presented as the best way to isolate these materials long term. Immersion is argued to bring oxidative reactions to a halt through persistent anoxia at depth (the tailing surface will be about 150 m below the lake surface) maintained by thermal stratification that will also inhibit mixing of contaminants of concern into the upper water column. Immersion will inhibit oxidation of acid forming materials in the pit wall to reduce acid and metalloid discharge from that source.

However, we consider that there is considerable uncertainty about the level of mixing that will actually occur^{viii}, especially if the lake is reconnected to the McArthur River (page V-21). We also understand that other chemical reactions can contribute to mobilisation of metals under aqueous low oxygen conditions, sometimes driven by micro-organisms that derive energy from metabolism of sulphides^{ix}. This uncertainty is acknowledged in “a contingency to isolate the mine pit lake from the McArthur River in the event that water quality is compromised by unanticipated chemical reactions ...” (page AB.21). But if sites of such reactions are close to groundwater flows, then as well as increased contamination of pit water, transport from the lake and expression in external surface waters may occur.

The EIS notes the existence of large “unknown” deeper groundwater connections between the underground mine workings and other parts of the landscape. Contamination reaching deeper groundwaters may also be expressed at the surface in upwellings - as the EIS suggests occur with some naturally saline waters (e.g. T-64) - or prevent productive and safe use of deeper groundwaters in the future. The EIS does not explicitly address issues associated with deeper groundwater contamination, emphasising interception of near surface groundwaters in natural drainage lines or interception trenches (e.g. 3-159, 164). The conditions under which deeper dewatering may be considered necessary and deployed through vertical and horizontal wells to extract contaminants of concern is not specified (e.g. pages, 3- T-51). Experience with interception wells at the TSF suggested they were ineffective and their use was discontinued (page T-50). Interception wells do not appear to be proposed in association with the NOEF, but they are mentioned as an option for the southern OEF (3-98).

Suggestions that the lake will, in a reasonable time, achieve water standards that permit reconnection to the river and allow discharge of near-surface waters under high flow conditions - and so help maintain pit water quality - are premature. And to set up the McArthur River as a permanent receiver of unspecifiable contaminant loads from multiple sources also appears to us to be unacceptable. It is irresponsible and potentially misleading to have informed the traditional owners that they may be able to use the pit waters (page Y.6) for any purpose in the reasonably foreseeable future.

In regard to catastrophic failure, the EIS offers assurances that pit walls will be stable over the very long term so that risks of collapse, and consequent re-mobilisation of sediments and a pulse of highly contaminated water entering the McArthur River are low. Similar types of risks may arise from failure of levees controlling water entry and outflow from or to the McArthur River. In our view any risk of such an outcome, for which there appears no plausible remediation, is too high.

Given these and many other related risks, we consider that alternatives to a lake must be more seriously examined.

4.6 Socio-economic and cultural issues

The analysis of socio-economic impacts is inadequate, partly because it was informed by a grossly inadequate consultation process (Section 4.1 above).

There is no treatment of impacts on the customary economy of the region, which may be substantial if there is no confidence in the health of food taken from it. Management, monitoring and reporting of mine biophysical impacts must be designed and delivered to build and support that confidence.

The incomes claimed and their contribution to GSP and GNP are impressive (e.g. Table 12-16), but it has been established repeatedly in many settings that trickle back to the regions feeling the effects of such developments rarely allows locals to enjoy the benefits^x.

The employment of a small number of local people and targets to increase Indigenous employment are obviously welcome (page 12-14). However, numbers are tiny as a proportion of the total workforce and likely to remain so, for reasons that are often outside of the control of the mine and difficult to overcome in a small remote community, such as uncertainty about ability or interest in working in such an environment and limited local availability of specialised skills. However, we consider that much more could be done to support local opportunity that would endure beyond life of the mine. One very effective approach to this would be to develop with local groups mechanisms to offset partially the long term residual impacts of the mine, which will be very substantial whatever choices are made about waste rock and tailings storage. In addition other environmental services might be purchased from Indigenous providers, including management of fire and weeds in and around the site to protect sites under rehabilitation.

In regard to tangible heritage, the archaeological material provided is reasonable in respect of the limited sites it documents, specifically those in the direct footprint of the proposal. Other impacts like dust and effects of blasting on rock art may extend beyond the active site. For example, Haglund^{xi} found art and camp site complexes of archaeological significance within the mineral leases, along Emu Creek and close to its junction with the McArthur River. There is no discussion of impacts and risks to these complexes. Other potentially relevant surveys were conducted in 1992, 2002 and 2005 by Hollingworth, Huonbrook and Begnaze consultancies respectively.

4.7 “Residual” risk, adaptive management and offsets

The EIS’ preferred approach to a large array of potentially severe environmental risks is to diminish their significance individually, or where plausible impacts are clearly unacceptable and undeniable, invoke unspecified future acts of adaptive management.

The NLC accepts that skilled and committed application of adaptive management theory and practice can be a most valuable approach to problem-solving^{xii}. However, crude trial and error of the sort that appears to have affected aspects of the site’s management in the past provides no base for adaptive management, especially when the errors resulting from flawed practice are treated by mine management as unchangeable, despite having undeniable potential to cause long-running impact. Adaptive management requires both commitment and capacity to withdraw the actions causing unwelcome change when required. Where actions cannot be withdrawn or reversed, but can have irreversible consequences, the only adaptation available is to learn to live with those consequences. This appears to be what the proponent requires of the people of the region and the Territory more generally.

Despite many perpetual impacts, not least the acceptance of ongoing uncertainty whatever the decision about in-pit disposal, there is no apparent interest by MRM in offsetting detriment of any sort at any level. This stance is facilitated by the Northern Territory's abandonment of environmental offsets, which in all other jurisdictions are treated as a critical component of the mitigation hierarchy.

The most likely result of present policy is that environmental outcomes in the Northern Territory will be inferior to those in other jurisdictions. Unless government requires developers to apply superior on-site management practices of a type, quality and cost not required in other jurisdictions, the Territory will not get the same biophysical outcomes achieved elsewhere through high quality offsets. There is certainly no evidence that regulators have set a higher bar for acceptable residual detriment, or that if they did, they would be capable of securing observance. There is also no evidence that MRM will itself pursue higher standards.

4.8 Weakness in the assessment process

As already noted, none of the specific environmental objectives, standards or closure conditions are seriously influenced by Aboriginal views and values. Moreover, mainstream and fundamental concerns that were clearly anticipated and documented in, for example, the 2006 assessment report by the agency equivalent of the NTEPA and recurring reports from the Independent Monitor, also appear to have failed to influence the current approach in any meaningful way. This raises fundamental questions about the capacity of the Territory's assessment and regulatory frameworks to deal with such large-scale projects and their effectively irreversible impacts on landscapes and lives.

The present EIS exemplifies the difficulties faced by affected parties seeking to protect their own interests or those of others to whom they have obligations. A huge volume of apparently competent and comprehensive technical analysis is presented, but embedded in an assessment of risk that muddles issues like corporate reputation with major biophysical impacts. Numerous biophysical risks are packaged in different ways and presented as probabilities varying by orders of magnitude. There is no attempt to present a coherent view of "aggregate" biophysical risk to permit meaningful assessment of the various alternatives or the real benefit to those who are expected to accept that risk. Critical parts of the risk equation, such as the financial and cumulative aspects, are available only as unsupported assertions.

We accept that analysis and presentation of aggregate risk and environmental and related costs is a difficult task, but consider it essential in cases such as this: if the assessment process is to be more than an elaborate but ultimately meaningless ritual. In the short time available for response to such complicated proposals, it would be unreasonable to suggest that private individuals, groups or organisations with legitimate interests might construct their own frameworks to assess aggregate risk that would permit them to present closely reasoned and convincing counter-arguments to those advanced by a development proponent.

We suggest that the empirical evidence of the damaging legacies of past decisions shows that such analysis is also beyond the reach of Northern Territory Government agencies and their regulatory tools as they are currently constituted.

4.9 Capability and commitment

We have noted acknowledgements in the EIS supporting documents that critical parts of the operation that contributed to the need for the present assessment failed to follow design intent

or approvals. These failings were not corrected at the time by the government regulator, and are now treated by the proponent as irreversible on financial grounds. Other departures from good practice and adverse outcomes have been revealed by the Independent Monitor^{xiii} who, for example, demonstrated that lead was entering food chains and has documented recurring failures to complete sampling and report incidents of exceedance of criteria. This role is extraordinarily valuable and obviously essential for this development, but insufficient for such major projects where actions can have major irreversible effects.

In our view, the Northern Territory Government places too much reliance on such *post hoc* mechanisms and not enough on direct oversight at critical points in project development. This may be largely due to resourcing constraints^{xvi} but, whatever the explanation, the issue certainly needs addressing. As noted above, when effective responses are ruled out of bounds, invocations of adaptive management by proponents or assessors (page Y-18) distort that body of theory and practice. No, or ineffective, response to all-but irreversible error is not adaptive management.

We are also concerned that regulators and other government agencies are exposed to conflicts of interest. The Department of Primary Industries and Resources (DPIR), for example, promotes investment in local mining developments^{xiv}. In records of consultations associated with this EIS, MRM reports laudatory comments from government personnel about progress made and criticism of others who raise concerns (pages Y-10, Y-19). However, it would obviously be much better for all participants if significant improvements in process, practice and outcomes were less often required following conspicuous problems and government personnel refrained from impugning the legitimacy of criticism.

Promoting sustainable development is an important role, but separating that role from statutory obligations must be rigorous, so that conflicts are demonstrably avoided.

4.10 Public exposure to risks and costs

The Terms of Reference for the EIS framed by the NTEPA include the statement that:

the Project may create an ongoing environmental, social and/or economic legacy if operations are required to cease ahead of schedule due to unforeseen circumstances, prior to the planned closure and rehabilitation of the site.

Necessary pre-conditions for such a risk in respect of biophysical environmental issues are:

- the bond held by the regulator is inadequate;
- patterns of development involve no increase in scale and impact of operations through time; and
- activity scheduled later in the life of the project includes measures to reduce the costs of rehabilitation at closure.

That is, the statement is relevant only if the regulator failed to secure an adequate bond that was accessible whenever needed and matched to the development trajectory and peak remediation needs.

We consider that a particular obligation of the regulator is to ensure that bonds are capable of meeting costs of rehabilitation that may arise at any and all stages of development. Otherwise the public is coerced to accept the risks and costs of corporate or project failure or poor proponent performance, however originating, and to tolerate or even to facilitate continuation of poorly-managed and environmentally destructive operations, because this is the most

accessible means of avoiding liability in the short term. The Territory is at risk of entrenching as standard practice a dependence on continued mining to manage impacts that should not have been permitted in the first place^{iv,v}.

Under this model - enabled by lax enforcement of environmental conditions and inadequate bonds - the worse the environmental performance early in a project, the greater the leverage accrued by a proponent to set future conditions. Policy appears to be moving in the wrong direction to avert such perverse outcomes, with the 2013 decision to reduce the size of bonds in “exchange” for a rehabilitation levy^{xv} obviously increasing the risks of under-provision by trading off present convenience against major future costs.

Neither MRM nor the regulator is prepared to reveal the size of the financial bond for the McArthur River Mine. However, this sort of statement from the NTEPA and related hints in the EIS - about risks of adopting more costly alternatives and ceasing mining prematurely - imply that neither the assessment authority nor the proponent believe that the bond would be adequate if mining stopped now.

This places Aboriginal and other local interests in an intolerable position: either to accept approaches to further development that they regard as flawed, or accept other unspecified (because hidden) risks of inadequate remediation. It is essential that environmental assessors and the wider public have full details of the remediation funds held and the conditions under which they can be accessed: so that relative costs and benefits of continuing or discontinuing operations can be weighed.

Given the quality of operations and regulator’s performance at this site and elsewhere, it is clearly untenable to leave such matters to undisclosed arrangements between the regulator and the proponent.

5 Conclusions

The EIS is clearly deficient in its present form. The proponent’s apparent reading of the levels of environmental harm and risk tolerable to the local, regional and other Northern Territory communities do not accord with the NLC’s understandings. The project could not be allowed to proceed on the basis set out.

Risks are greatly exacerbated by the weak levels of commitment and capability displayed by Northern Territory regulators. The NTEPA has recognised and documented some of these issues^{iv,v,xvi}.

Despite the embarrassing history of continuous environmental management failings at this site, the EIS presents no evidence of fundamental shifts in quality of commitment or capability to deliver on commitments. This is, in our view, evidence that the system for representing and protecting the environmental interests of Northern Territory residents is not taken seriously. Urgent action is required to restore balance and integrity, and the capacity to achieve equity of access to benefits and fair sharing of costs of development across society.

6 Recommendations

Given that we regard this project as an exemplar of deep systemic problems, our recommendations run from specific project issues and requirements for additional information, through to proposals for review of law and process.

In general it is apparent to the reader that a proper assessment and consideration of aggregate (total) risk in relation to the management of overburden at the mine site has not been presented by the proponent as part of this EIS. The conclusions reached throughout the EIS are not always supported by empirical evidence or otherwise sufficiently justified. To rectify these and the specific deficiencies raised below, the regulator should insist that further work be undertaken and the findings presented to the public for all stakeholders to consider. The publicly available information should include full disclosure of projected long term costs.

It is the NLC's view that if all highly reactive material, and the bulk of the remaining reactive material, were reinterred back into the pit at below groundwater levels with a suitable impermeable cover and other engineered solutions that include dealing with the tailings, that superior environmental outcomes would be achieved in comparison to the alternative scenarios. That said further research is required to draw any definitive conclusions about the long term feasibility of all scenarios being considered. In this regard the proponent should be required to undertake further investigations and to present the results and underpinning assumptions, including the financial, to allow stakeholders to have a full and proper understanding of the project and its likely impacts. The final design should be one that achieves the best possible environmental outcomes.

6.1 Engagement of Aboriginal Interests

- 1) The approach to consultation as presented in the EIS does not satisfy the requirements of the Terms of Reference (TOR). The process is required to:
 - engage with the relevant statutory organisations, in particular the NLC, via established and transparent processes, to consult with native title holders on matters that will have long term impacts on their native title rights and interests;
 - show how key risks were appropriately described to local Aboriginal stakeholders, and their views sought on all of those risks;
 - identify which stakeholders are required to accept residual risk, and show that these people were effectively and objectively consulted;
 - demonstrate that information about alternative scenarios and risks associated with mine closure were comprehensively identified and issues arising addressed; and
 - show how Aboriginal values and interests were taken into account in project design and consideration of alternatives.
- 2) If the proponent is unable to provide such evidence of fully informed consultations with the correct people, the NTEPA should require engagement of suitably qualified specialists to ascertain and report stakeholder views on the alternatives and risks.
- 3) Advice is required on whether signatories to the agreement about the height of the proposed NOEF relative to the relevant sacred site were offered opportunity to seek independent legal and technical advice on the impact that the signing of this agreement may have.

6.2 Social and cultural impacts

- 4) The EIS provides no meaningful assessment of social and cultural impacts on Aboriginal people. The proponent should be required to engage a suitably qualified expert to research

and report on the potential social and cultural impacts of the proposal. The NLC is able to provide information relevant to this matter on request.

- 5) The current status of, and potential impacts to archaeological sites in the area, particularly documented sites located along Emu Creek and including sites outside the mining leases, should be further investigated.

6.3 Mine operations and closure

- 6) Proposals for mine operations and closure should be reconsidered to include:
 - reconfiguration of the existing NOEF as soon as possible to reduce seepage and oxidation problems, as a condition of further mining;
 - in-pit storage of tailings and reactive overburden, with optimal design determined independently²;
 - use of bituminous liners or similar impervious materials to improve isolation of reactive waste during temporary storage (pending in-pit disposal) be re-examined;
 - extend monitoring of lead in tissues to include all species taken for consumption by Aboriginal and other local people; and
 - rigorous testing of all alluvium to be used in PAF cell construction.
- 7) More and better information is required on:
 - total loads of persistent contaminants, especially metals, and their ultimate long term distribution and concentrations in all potential receiving environments should be seriously examined, irrespective of concentration at release into the McArthur River;
 - management of dust in and around all over-burden storage facilities given that the apparently preferred method of watering cannot be used;
 - direct evidence that thermal imaging systems (will be capable of detecting change early enough permit intervention before substantial SO₂ has been generated and is detectable by gas monitoring systems;
 - risks and risk treatments regarding contamination of deeper groundwaters that cannot be intercepted at the surface by proposed measures;
 - criteria for determining whether interception bores are required and configuration of interception arrangements;
 - options for limiting groundwater exchanges with the pit at all depths, whether flooded or not and whether used for tailings or overburden storage or not;
 - the potential for ongoing reactions involving sulphides in the pit even under low oxygen conditions;
 - where excessive cost is asserted as a reason for rejecting use of obviously superior methods to reduce serious environmental harm, then full disclosure of the costs are required;
 - given assertions that mining will cease if conditions for improved environmental management increase costs, information on the size of the bond available for immediate remediation should be made publically available; and
 - statements of aggregate risk that provide insights to the probability and impacts of one or more serious failures of mitigation measures over specified time periods.

² The Supervising Scientist, Department of Environment, may be able to assist given recent experience with the Ranger Uranium Mine in Kakadu National Park.

6.4 Improved assessment and regulatory process

- 8) The seriousness of the present situation should be communicated to government with a view to urgently correcting the management difficulties with this project, but also going further to examine statutory and other change to drive better assessment outcomes and develop suitable management processes, including:
- informed public participation, especially proper engagement with Aboriginal people; and
 - reconsideration of agency structures and policies that generate apparent conflicts of interest in dual roles to promote developments and then set conditions for and oversee their operations; and
 - systemic improvements in the handling of major development projects in the Northern Territory, including improved and transparent arrangements for handling rehabilitation bonds; and
 - restoration of robust systems for environmental offsets; and
 - obligatory public release and unfettered access to all monitoring and reporting data gathered as a condition of approvals.
- 9) To help inform review of law, practice and administrative arrangements, this project should also be subject to a comprehensive independent review covering all relevant operational and regulatory decisions and influences on performance.

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ATTACHMENT 1 – CULTURAL HERITAGE, SOCIO-ECONOMIC ENVIRONMENT AND CONSULTATION PROCESSES

The principal shortcomings related to chapters 11 and 12 of the EIS are summarised as follows:

- inappropriate application of anthropological concepts and terminologies, which have implications for the project that are detailed below;
- application of stakeholder engagement methodologies which do not align with the requirements of the TOR provided by NT EPA, or comply with leading practice standards;
- inadequate consideration of the impacts to cultural heritage; and
- inadequate assessment of the cultural and social impacts of the proposal.

It is the NLC's opinion that the additional works listed below are required to be completed in order to comprehensively describe the potential impacts of the proposal in respect of chapters 11 and 12 of the EIS. The proponent is urged to:

- (1) engage with the relevant statutory organisations, in particular the NLC, via established and transparent processes, in order to consult with native title holders on matters that impact on their impact native title rights and interests;
- (2) engage independent specialists to undertake a consultative process which properly ascertains and considers stakeholders' views on the alternative scenarios and risks addressed in the TOR provided by the NT EPA;
- (3) conduct further research and report on the potential impacts to cultural heritage sites located off the mineral leases, and
- (4) engage suitably qualified independent professionals to conduct further research and produce reports on the cultural and social impacts of the proposal to inform the final EIS.

Inappropriate application of anthropological terms and concepts

As a basis for consultations with local Aboriginal stakeholders, the proponent and authors of relevant sections of the EIS attempt to group stakeholders according to their interests; particularly whether or not they are a "traditional owner" (see Appendix 8 of Appendix Y). This is problematic because there is no definition provided to inform the reader of how the proponent and authors identify a traditional owner. For example, is the person identified as a traditional owner of the area within the mineral leases, the area directly affected by the enlargement of the waste rock dump; or of another area somewhere else? This raises further questions, for example, on what basis is someone identified as a traditional owner? Are they a traditional owner of their father's country, or is the title of traditional owner inherited by some other means? Describing a person as a traditional owner has limited utility, unless some rationale is provided to enable the reader to critically analyse such rationale. It is difficult to rely on the indigenous stakeholder data provided in the EIS because no information is provided to define the term or inform the reader how a person becomes identified in the EIS.

The estate groups identified to hold native title rights and areas in the McArthur River Station have been set out in the Native Title Determination. Therefore, it would be appropriate and less problematic in stakeholder analysis to consider which stakeholders hold native title rights and interests in affected lands and waters rather than presenting information about traditional ownership. Chapter 12 p.12 states that "*A comprehensive cultural heritage assessment was*

ATTACHMENT 1 – CULTURAL HERITAGE, SOCIO-ECONOMIC ENVIRONMENT AND CONSULTATION PROCESSES

undertaken as part of the project, which aimed to identify native title holders ...", however the assessment process and its outcomes of this assessment are not described anywhere in the EIS.

The attempt to apply anthropological terminologies in the EIS is problematic, and the problems that arise from this are further compounded by the fact that such terms are wrongly, and inconsistently applied. Critical discrepancies in the data on traditional owners provided in the EIS include:

- Of those listed as traditional owners in Appendix 8 of Appendix Y, a substantial proportion of people listed are not, in NLC's opinion, traditional owners of the area within the mineral leases directly affected by the enlargement of the waste rock dump;
- there are a number of people listed in Appendix 8 of Appendix Y, who, in NLC's opinion, are traditional owners of lands directly affected by the enlargement of the waste rock dump but who are not listed as traditional owners; and
- the graph on page 29 of appendix Y reflects these errors.

How it is decided that a person is a "senior man" as described on page 29 of Appendix Y is not described. At times the EIS applies the term "custodian", in respect of people with particular responsibilities for sacred sites, but again there is no relevant definition provided, or explanation of how or why the term is applied by the authors to particular persons. As a result consultations by the proponent with site custodians on issues related to sacred site protection are of questionable value given the lack of information about the consultation process and the process involved with identification of custodians.

Failure to engage appropriately with relevant organisations on the above

Because identification of and consultation with native title holders is among its core statutory functions, the NLC:

- i) employs anthropologists with expertise in the field;
- ii) manages large quantities of relevant anthropological data, and
- iii) drives well established processes by which these tasks are administered.

The NLC is able, on request, to provide advice in relation to these matters. There has been no request from the proponent that the NLC provide information in respect of native title holders or traditional owners of affected areas.

The proponent directly consults people they consider to be traditional owners or custodians of sacred sites, without engaging with the organisations who normally manage such consultations. In the case of sacred sites it appears (from information provided in the EIS) that Authority Certificates were requested from the Aboriginal Areas Protection Authority (AAPA) *after* the proponent directly sought to negotiate an agreement with people whom the proponent considered to be sacred site custodians. No rationale is provided for this approach. It raises the question as to why the proponent did not seek advice from the NLC, or engage in AAPA's established Authority Certificate application processes prior to seeking agreement from these custodians. The risk that this strategy may result in the proponent consulting the wrong people is identified on p.46 of Chapter 12. The proposed mitigation measures applied to this risk by the proponent are flawed as described in the preceding section. The risk of causing or exacerbating conflicts within the community are not identified by the proponent, but are of relevance in respect of this project.

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It is of note that in Appendix 7 to Appendix Y, the NLC is described as having a cultural interest rather than a governance interest. It appears that the proponent has failed to recognise the statutory functions of the NLC. Page 10 of Appendix Y locates NLC in the "Keep Satisfied" grouping of stakeholders along with other non-regulatory government agencies. As NLC has not been involved in the consultation process by MRM with the local Aboriginal people, the NLC is unable to be satisfied that the relevant custodians and native title holders have been consulted both recently in regard to this EIS and historically in relation to the MRM project in general.

Project-specific implications

The definition of custodians and traditional Aboriginal owners is a particularly sensitive point because, on the basis of information provided in the EIS (particularly the Stakeholder Consultation Report), it appears, in NLC's opinion, that custodians of a sacred site significantly impacted by the proposal, were not consulted. Therefore the agreement negotiated between the proponent and the custodians of this sacred site³ with regard to the proposed NOEF, is highly problematic. The NLC is of the view this agreement may have been executed without all relevant custodians having been consulted. Because the agreement has been negotiated and executed without the involvement of the NLC, it is not possible to provide any further comment on this issue.

The NLC requests that the proponent provide the following information in the final EIS:

- evidence that risks were appropriately described to stakeholders, and their views sought;
- identify which stakeholders are required to accept residual risk, and provide evidence that these people were effectively and objectively consulted; and
- Mine closure is particularly relevant to indigenous people who hold native title rights to the area covered by the mine and these rights endure through generations and will come into full effect upon the expiry of the mineral leases covered by the mine. The NLC requests evidence to demonstrate that information about alternative scenarios and risks associated with mine closure:
 - were comprehensively identified and addressed;
 - were effectively communicated (i.e. to a non-specialist audience of which many do not speak English as their first language); and
 - were objectively presented.

Should the proponent be unable to provide such evidence, the NLC recommends that suitably qualified and independent specialists be engaged to undertake consultations which ascertain and describe stakeholders' views on the alternatives and risks as presented in the NT EPA's TOR.

In respect of point 2 above, I refer the proponent to industry leading practice, operating principles for Respecting Indigenous Peoples and Traditional knowledge:

“Safeguard against exploitation: Build in safeguards to protect indigenous communities that are vulnerable to unfair exploitation, e.g., because of inexperience ...”
(Croal et al 2012)

³ This agreement is referred to in the EIS, but has not been provided to, viewed by, or discussed with the NLC.

ATTACHMENT 1 – CULTURAL HERITAGE, SOCIO-ECONOMIC ENVIRONMENT AND CONSULTATION PROCESSES

Chapter 12 p.46 refers to a database kept by the mine which is said to record stakeholders and their relationship with the mine. The indigenous stakeholder data provided in the EIS includes significant error and raises concerns about the integrity of the proponent's dataset, and the methodologies on which the proponent's data was collected. Given the errors presented in the EIS, the NLC questions whether or not a qualified anthropologist was engaged by MRM to oversee stakeholder engagement. The NLC is also concerned that stakeholders recorded in this database may not have provided their consent to have their personal information either held by the company or made public via the EIS process.

Objectivity in the consultative process

Given the history of community concerns in relation to this project, it is advised that the proponent make more effort to maintain high levels of independence and objectivity in the stakeholder consultation team; i.e. to build a team that can best ascertain the views of stakeholders without appearing to have a commercial or economic interest in promoting the project. The EIS consultation team of 6 people comprised 4 MRM staff (Y-15).

There is little material to facilitate qualitative analysis of any consultations that occurred. The table provided at Appendix 2 to Appendix Y ("*Stakeholder Consultation Register*") provides a table listing who was consulted and when. However there does not appear to be a clear description of the specific questions and issues raised by the consulting team or any information describing stakeholder engagement methodologies. For example techniques that may be employed in community meetings to facilitate effective engagement with a broad range of participants, or alternative techniques applied to assist in group decision making.

Industry leading practice on public participation (PP) requires that stakeholder engagement processes be:

“Credible and rigorous – PP should adhere to established ethics, professional behaviour and moral obligations. Facilitation of PP by a neutral facilitator in its formal or traditional sense improves impartiality of the process as well as justice and equity in the right to information. It also increases the confidence of the public to express their opinions and also to reduce tensions, the risk of conflicts among participants, and opportunities for corruption. In a formal context, the adoption of a code of ethics is encouraged.”

(Andre et al, 2006)

The TOR provided by the NT EPA (TOR-20) reflects these standards in the requirement for objectivity during discussion of the risks and impacts associated with the proposal. However, there is no evidence that such objectivity was featured in these stakeholder consultations. The communication tools provided as appendices to Appendix Y heavily promote the benefits of the proposal, for example in economy, employment and consultative effort.

The NLC requests that the proponent provide the following information in the final EIS:

- evidence that risks were appropriately described to stakeholders, and their views sought;
- identify which stakeholders are required to accept residual risk, and provide evidence that these people were effectively and objectively consulted; and

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- Mine closure is particularly relevant to indigenous people who hold native title rights to the area covered by the mine and these rights endure through generations and will come into full effect upon the expiry of the mineral leases covered by the mine. The NLC requests evidence to demonstrate that information about alternative scenarios and risks associated with mine closure:
 - were comprehensively identified and addressed;
 - were effectively communicated (i.e. to a non-specialist audience of which many do not speak English as their first language); and
 - were objectively presented.

Should the proponent be unable to provide such evidence, the NLC recommends that suitably qualified and independent specialists be engaged to undertake consultations which ascertain and describe stakeholders' views on the alternatives and risks as presented in the NT EPA's TOR.

Social, Cultural and Economic impact assessment

The archaeological material provided in the reports may be reasonable in respect of the limited number of sites it documents. However these sites appear to be restricted to those located within the direct footprint of the proposal. Impacts on cultural heritage sites may include off-site impacts for example as a result of dust or blasting on rock art.

Haglund (1975) found art and camp site complexes of archaeological significance within the MLs, along Emu creek and close to its junction with the McArthur River. There is no discussion of impacts and risks to these complexes. Other potentially relevant surveys were conducted in 1992, 2002, and 2005 by Hollingsworth, Huonbrook, and Begnaze consulting agencies respectively.

The NLC recommends further investigations be conducted into the current status of, and potential impacts to archaeological sites in the area, particularly those documented sites located along Emu Creek.

Chapter 11 Cultural Heritage is of relevance to this issue; it is noteworthy that:

- P.1 identifies legislation relevant to cultural heritage but does not include the *Native Title Act*.
- P.4 section 11.3.2 lists site complexes and historical archaeological surveys and notes the Haglund study but does not list the Emu Creek complexes Haglund documented.
- P.23 describes consultations with the custodians of a sacred site but does not explain what custodianship means in this context.

Chapter 12 Socio Economic Environment is inadequate: while an economic impact assessment is presented at appendix Z there is minimal analysis of social impacts. There appears to be no analysis in the EIS of potential cultural impacts as undertaken by a suitably qualified expert. The impact of the proposal on locally specific indigenous economies (for example, on subsistence economies, the injection of monies from agreements into distributive kinship economies) appears not to have been considered in the EIS.

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The NLC recommends that a suitably qualified expert be engaged to research and report on the potential social and cultural impacts of the proposal.

References

André, P., B. Enserink, D. Connor and P. Croal 2006 *Public Participation International Best Practice Principles*. Special Publication Series No. 4. Fargo, USA: International Association for Impact Assessment.

Croal, P, Tetreault, C., and members of the IAIA IP section (2012) *Respecting Indigenous Peoples and Traditional Knowledge*, Special Publication Series No 9. Fargo, USA: International Association for Impact Assessment.

Hagund, L (1975) *Survey of Sites Significant to Aborigines McArthur River Region Northern Territory*. Dames and Moore Job no 7177-001-70. 6165/D/22.

ATTACHMENT 2 – ISSUES RELATED TO SPONTANEOUS COMBUSTION

Spontaneous Combustion at the McArthur River Mine

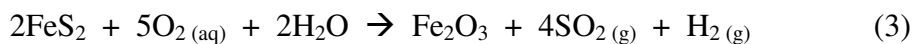
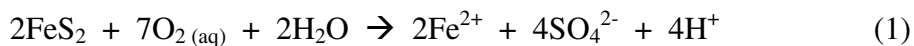
This part of the NLC's submission considers only the process of spontaneous combustion of mined, waste and processed materials. It seeks to assess how well MRM understands spontaneous combustion and how spontaneous combustion will be managed during operations and following closure of the mine.

Outcomes below are based upon assessment of Sections 3, 4, 6, 7, 13 and 15 and associated Appendices H – R inclusive, S, AD and AF.

1. Spontaneous Combustion and AMD

Spontaneous combustion may occur when sulphide and carbon rich rocks oxidise in the presence of water and the atmosphere. This process is common in the coal industry and it is from the coal industry where most of the advances in management have been drawn. However, spontaneous combustion may also occur where ore deposits containing fine-grained, disseminated pyrite (FeS_2) and carbonaceous materials are exposed to the air (Landers and Usher, 2015). In their EIS, MRM have identified three stratigraphic units (black bituminous shale, upper pyritic shale and lower pyritic shale) that have greatest propensity to spontaneously combust (p4 Appendix AF).

Spontaneous combustion is characterised by high temperatures and release of gases, especially H_2S and SO_2 . These gases may be released directly to the atmosphere or may dissolve in water, releasing acidified contaminants, often referred to as acid mine drainage (AMD). AMD can also occur through breakdown of potentially acid forming materials (PAF), without the assistance of acidic gases released by spontaneous combustion. Numerous chemical reactions may occur, four of which are identified below:



Hydrogen sulphide (H_2S) and elemental sulphur (S) may be produced deep within the rock dump, where there is insufficient oxygen available for combustion. Following reaction 1, the sulphate (SO_4^{2-}) and hydrogen (H^+) ions may combine to create sulphuric acid (H_2SO_4), which reacts with surrounding material to generate AMD. The quantity and rate of localised acid generation from the spontaneous combustion of iron sulphides will depend on how much of the SO_2 is released to the atmosphere, and how much combines with water to form H_2SO_4 within the waste rock.

Although O_2 is needed to oxidise pyrite, it is the amount of water vapour in the atmosphere that is critical to spontaneous combustion. Oxidation of pyrite and spontaneous combustion increases rapidly once the atmosphere's water vapour content exceeds 20% and may be further enhanced if pyrite is present as fine particles (Pahlman and Reimers, 1986). This suggests that significant problems may occur in hot, humid environments and that an assessment and management of risks should focus on manual handling and isolating materials from the atmosphere to reduce instances of spontaneous combustion and related AMD.

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2. MRM's assessment of risk

The principal risks related to spontaneous combustion and AMD considered by MRM are consistent with the processes outlined above. They include:

- increased geochemical load on pit water (through AMD);
- release of SO₂ from the NOEF;
- release of AMD contaminants from the NOEF during new construction work;
- release of SO₂ from spontaneous combustion of tailings; and
- release of SO₂ from spontaneous combustion during partial backfilling of the pit.

3. Management of spontaneous combustion during operations

There appears to be little consideration given in the EIS to how management of existing material on the NOEF is to be improved. Prior to this EIS, PAF material was categorised mainly according to its acidity and AMD generating capability, which appears to have allowed some highly reactive materials to have become distributed throughout the NOEF. If this is the case, sporadic episodes of spontaneous combustion may continue to occur until the NOEF is provided a stable, impermeable cover. This may need to be re-assessed as the project progresses and contingencies put into place until such a cover is established.

The main principles to be applied to future management of reactive PAF material are construction of dedicated cells in which it is to be contained, low lift construction and compaction, dry season mining and covering during the wet season (p6-63 & p 6-64). The more important actions proposed by MRM are:

- MRM has reclassified its material in an effort to improve identification and segregation of materials that are likely to spontaneously combust (p6-22).

Reclassification of material is no longer based on pH, but considers the materials' geochemistry (and especially the sulphur content) when describing materials considered to be reactive and with acid-forming potential. Reclassification is a positive move because in this case, it increases the volume of material that is identified as not environmentally benign and requiring management.

- MRM plans to undertake early detection of reactive materials during mining and daily monitoring of the NOEF for AMD, thermal energy, SO₂ and visual signs of reaction (p15-26) to help manage spontaneous combustion.

Early detection of potentially reactive material during the mining phase is one of the key proactive measures to reduce spontaneous combustion events by segregating and correctly placing material in the NOEF. Thermal monitoring of the NOEF would allow MRM to identify areas where spontaneous combustion events are occurring, but would not be useful as a predictive management tool unless it can clearly identify a temperature at which combustion commences. The EIS does not appear to present any direct evidence that the thermal imaging system it proposes to use is capable of this degree of definition for material at the MRM mine site.

Similarly, measurements of SO₂ (and other toxic gases) and heat plumes serve as useful indicators that combustion events are occurring or have occurred, but they are unsuitable as predictive or preventive tools. The environmental management plan provided does not

ATTACHMENT 2 – ISSUES RELATED TO SPONTANEOUS COMBUSTION

provide advice on how to manage SO₂ once it is released. MRM's main aim is to prevent formation of SO₂ by encapsulating the bulk of the PAF in an above-ground facility. Encapsulation should include all material existing within the NOEF – which should be considered to be reactive by virtue of it not having previously been segregated according to the newly proposed classifications and its known propensity to spontaneously combust.

Maintenance of the above-ground facility thus becomes critical and its suitability beyond life of mine must be questioned because it may or may not have long-term resistance to erosion and weathering in the tropical environment. If integrity of the facility cannot be maintained once the mine has closed and MRM has departed the risk of further and possibly larger spontaneous combustion events (created by the concentration of combustible materials into confined spaces) will increase over time. Under these circumstances, MRM will not achieve its ambitious performance indicator that “major spontaneous combustion events must not occur on the NOEF during the operational phase, and no spontaneous combustion must occur following closure” (p15-25).

MRM's measures for the management of AMD are generally reactive and focus on monitoring and capture of contaminated water. Ideally, all waste rock materials should be returned to the pit void and isolated from the air at the end of mining if spontaneous combustion and AMD is to be avoided.

- Reactive PAF materials will be mined primarily during the dry season, and then placed into dedicated cells in the core of the NOEF, where they will be compacted. A layer of 100mm of compacted alluvial sheeting will be placed on top of every 2m of reactive PAF material within each cell. Temporary covers consisting of alluvial and non-acid forming material will be in place prior to each wet season (p15-25, p3-104).

Better segregation of reactive material as proposed by MRM should result in a reduced risk of spontaneous combustion; however the effectiveness of the 100mm alluvial layer in dissipating the heat generated and isolating the atmosphere must be questioned. When materials spontaneously combust, temperatures in excess of 350°C may be generated and create a self-sustaining process. The alluvial cover layers may not be of sufficient thickness or resistance to insulate other reactive PAF layers above or below and prevent spread of the reaction.

If the alluvial layers are unable to effectively dissipate heat or isolate reactive PAF from the atmosphere, spontaneous combustion may continue to occur sporadically during placement in the cells, or deep within the NOEF once it has been buried. Materials proposed for use in construction of the alluvial layers should be tested and information regarding their ability to transmit heat, water and air when compacted should be provided so that risk of long-term failure can be assessed.

- MRM plans to flatten the batter slopes of the NOEF and install advection barriers to reduce the potential exposure of PAF material to the atmosphere. This will be supported by air and water quality monitoring and systems designed to capture highly contaminated water (BB31, p7-35).

This statement is inconsistent with the project description and justification which indicates that in the future, the NOEF will be trilinear concave batter slopes increasing from 1V:4.5H to 1V:3.5H to 1V:2.5H at the top (p 3-110). The EIS does not appear to contain details of the current NOEF batter slope.

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Advection barriers are designed to control air and/or water flow through the NOEF and if the model presented is correct, they should provide an additional layer of protection against spontaneous combustion or AMD generation deep inside the NOEF. However, the model has several shortcomings because it doesn't account for oxygen transport through the alluvium; it assumes the advective material is homogeneous; and does not consider changes in temperature, air pressure and saturation (Appendix I, Section 7.2). Materials proposed for use in construction of the advection barriers should be tested and information regarding their suitability under a range of climatic conditions should be assessed and provided.

- The exposure of tailings during re-mining may lead to generation of AMD and/or SO₂. MRM plans to manage tailings exposure by using a hydraulic process that includes irrigating and monitoring the surface of the TSF to minimise exposure (BB64, p7-36; BB45 p7-37, p3-177).

MRM has proposed an option to mine and reprocess its tailings and place the residual material into the pit void at time of mine closure (Appendix R, p79). This is a positive step that should continue to be encouraged.

The hydraulic recovery process proposed should maintain the tailings in a state, however drying of the tailings material may create the risk of dust or spontaneous combustion following oxidation of any residual sulphides. Tailings have been previously classified by MRM as PAF material, but have not been reclassified in the new EIS. Consequently, tailings management is unchanged and has not been considered in this EIS (p3-9).

The EIS does not contain a detailed description of tailings geochemistry, but MRM has previously claimed that “geochemical testing indicates that the tailings have an inherent acid neutralising capacity (ANC), which reduces the risk of the tailings oxidising and generating acidic conditions” (URS 2008). This seems to contradict the statement that they are potentially acid forming. However, entrained pore water holds high concentrations of sulphate and, under present storage conditions or during transfer to the pit, this may be a more significant concern.

If tailings are considered to be PAF material, the use of a hydraulic process to recover and transfer them to the pit void appears to be an appropriate means of managing the associated environmental risks.

- MRM plans to reduce the risk to workers during in-pit rehabilitation by engineering and management controls including monitoring and ventilation of the pit atmosphere and segregation of highly reactive materials until they are placed into the pit when operations cease (BB43, p7-36).

The release of SO₂ in the pit is a safety concern for mine workers that the company will find difficult to manage. Early removal of materials from the pit is a practical means of reducing the probability of spontaneous combustion events once the material has been mined, but will not reduce the risk of combustion at the pit wall prior to or during mining. It is difficult to conceive how it will be possible to ventilate a large pit, should the SO₂ concentration become high across the pit. This part of the plan would be better understood if more detail on the controls proposed and records of SO₂ levels in the pit were provided in the EIS.

It is hoped that MRM will continue to research management of spontaneous combustion in overburden facilities and implement improvements as leading practices evolve.

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4. Management of spontaneous combustion following mine closure

The key to MRM's future management of spontaneous combustion rests with identification, classification and management of waste materials. Most of the matters related to this have been discussed in section 3 of this assessment.

- MRM plans to place highly reactive material into the pit and rapidly cover the pit to reduce exposure to the atmosphere (BB43, p7-36).

This should be implemented for all reactive and PAF materials, including those already existing in the NOEF.

- MRM plans to isolate pit waters in the void surrounded by a levee. Additional measures may include treatment of the water until it is of sufficient quality to allow flow through (BB58, p7-26).

Isolation of contaminated water in the pit void should only be considered a temporary measure because the body of water may be largely unusable and the levee will ultimately erode and release some of it into the environment. Treatment of the water will be imperative if it does not meet certain environmental requirements.

- The post-mining overburden facility is being redesigned so that reactive waste is segregated in purpose-built PAF cells to minimise contact with oxygen and water (BB48, p7-34).

The concept of segregating reactive waste is a positive, albeit expected move, although return to the pit void is preferred.

5. References

Landers M. and Usher B.H. (2015): Management of spontaneous combustion for metalliferous mines, 10th ICARD IMWA, April 20 – 25, Santiago, Chile.

Pahlman J.E. and Reimers G.W. (1986): Thermal gravimetric analysis of pyrite oxidation at low temperature, Report of investigation #9059, United States Department of the Interior, Bureau of Mines, Washington DC, USA.

URS (2008): McArthur River Mine Open Cut Project Public Environmental Report, Section 7 – Tailings Storage Facility, p7-21.

6. Concluding remarks

It is the NLC's opinion that:

- The chemistry of spontaneous combustion of waste rock materials and formation of AMD is more complex than has been discussed by MRM in its EIS;
- Analysis of the geochemical characteristics of waste rock is sufficiently comprehensive and has allowed an improved categorisation of reactive PAF materials;
- Future management practices to be put in place should be adequate for reducing the environmental and health risks of the range of gases and water soluble by-products (including those not specifically identified) that may be produced by spontaneous combustion of materials at MRM during its future operations;

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- The effectiveness of alluvial layers in insulating pockets of reactive PAF within the NOEF may require further investigation;
- The existing NOEF contains reactive PAF material dispersed throughout, and this will require management consistent with the improved approach presented in the EIS if further episodes of spontaneous combustion are to be prevented;
- All management practices can be improved. MRM should continue to research spontaneous combustion and develop current leading practice so that improved long-term beneficial outcomes can be achieved;
- The overburden emplacement facilities are located on a floodplain and within a high rainfall, monsoonal part of the Northern Territory so long-term erosion, leading to eventual exposure of reactive PAF materials remains a serious concern; and
- A more permanent solution to limit exposure of reactive PAF materials and prevent AMD would involve re-internment in the pit void and covering it with an impermeable solid cover, maintaining it below the standing groundwater level or both.

McAthur River Mine
Overburden Management Project – Draft EIS
PUBLIC SUBMISSION FOR THE PURPOSES OF THE ENVIRONMENTAL IMPACT
ASSESSMENT PROCESS PURSUANT TO THE NT & CTH ASSESSMENT BILATERAL
ENVIRONMENTAL ASSESSMENT ACT (NT)
ENVIRONMENT PROTECTION & BIODIVERSITY CONSERVATION ACT 1999 (Cth)

Filed by:

Environmental Defenders Office NT Inc.
PO Box 4289
Darwin NT 0801
(08) 8981 5883
david.morris@edont.org.au
17 May 2017

SUBMISSIONS ON THE DRAFT EIS:

CLIENT GROUP:

The Environmental Defenders Office (NT) Inc (**the EDO**) has been instructed to act for the following people in the preparation of this submission and it is made on their behalf:

Jacky Green
Josephine Davey
Nancy McDinny
Isa McDinny
Stewart Hoosan

Gadrian Hoosan
Conrad Rory
Myra Rory
Joy Priest

Together, “**the EDO’s clients**”

GROUP SUBMISSION

This submission is made on behalf of the EDO’s clients. Each of them has differing cultural rights and responsibilities for various areas of Country in the Gulf of Carpentaria. Activities occurring at the McArthur Rive Mine (**the Mine**) have the potential to impact offsite areas. Despite this potential, McArthur River Mining Pty Ltd’s (**MRM**) consultation processes have extended only superficially to local stakeholders other than the traditional owners of the area on which the mine site is located.¹ Clearly, the Mine site’s traditional owners are important stakeholders and the EDO’s clients do not seek to undermine any statements made by them, or their authority to make such statements. However, the features of the Mine mean that the obligations for meaningful engagement (by both MRM and the Government) with all four clan groups should be a precondition to any approval of the OBMP.

EXPERT REPORTS

The EDO’s clients have gone to great lengths to obtain expert reviews of various aspects of the Draft EIS. The following reports are attached to this submission and should be considered in their entirety.

- Attachment A: Review by Associate Professor Gavin Mudd – Environmental Engineering, RMIT University.
- Attachment B: Review by Professor David Airey – School of Civil Engineering, University of Sydney
- Attachment C: Review by Professor Abbas El-Zein – School of Civil Engineering, University of Sydney
- Attachment D: Review by Associate Professor Barry Noller, Centre for Mined Land Rehabilitation, University of Queensland.
- Attachment E: Review by Dr Geoff Vietz, Director of Streamology – Waterway Science and Management
- Attachment F: Review by Dr Erica Garcia, Research Institute for Environment and Livelihoods, Charles Darwin University.

¹ Consultation processes and their deficiency in terms of best practice is discussed below.

SUMMARY OF SUBMISSIONS:

The EDO's clients are deeply concerned about the impact of the McArthur River Mine on the environmental and cultural values of the Gulf; they are particularly concerned about impacts to the McArthur River down stream of the mine site. Because of these concerns the EDO's clients have engaged a variety of experts to review the Draft EIS.

General opposition to continued mining

The EDO's clients are generally opposed to the continued mining at McArthur River Mine because of the problems already created through bad decision-making, poor quality environmental assessments and mismanagement at the site. The EDO's clients view the risks as too great and the benefits too few to justify the approval of the OBMP thereby allowing continued mining at the site until 2037.

Recommendation 1: That the NTEPA recommend that the OBMP be refused approval. That the responsible NT Minister and Commonwealth Environment Minister refuse approval of the OBMP.

Despite this general opposition to the approval of the Overburden Management Project (**OBMP**) the EDO's clients make the following additional recommendations (which are outlined in greater detail below):

Public participation in the EIS process

Recommendation 2: In view of the absence of efforts to comply with cl 7.3 to date, that prior to providing public comments to MRM for the preparation of the supplementary EIS, the NTEPA make specific arrangements for Indigenous members of the Gulf to make comment on the OBMP should they wish to.

Recommendation 3: All submissions to the Draft EIS be made public – including (and particularly importantly) the review submission by ERIAS.

Recommendation 4: In light of the deficiencies in the process outlined above, the NTEPA and Commonwealth Minister should seek further information from local stakeholders, particularly in relation to matters of cultural significance and proposed closure planning and future land use.

Recommendation 5: To allow greater public scrutiny and transparency, as part of the EIS supplement, MRM should include all original data sets, rather than just summaries/extracts.

Project alternative – complete backfill

Recommendation 6: The EIS Response Document must include a realistic scenario which ensures all PAF material is sequenced as deep as possible in the former pit. As part of the process, the broader Borroloola community must engage meaningfully in ascertaining their preferences for complete backfill – with a multi-criteria analysis or approach which properly allows for their social and environmental preference to be included as equal weight to financial or economic considerations (i.e. cost alone should not dominate rejection of the complete backfill scenario).

Closure costs and security bond

Recommendation 7: The Supplementary should specifically address the issue that Glencore (MRM's parent company) is unlikely to bear liability for acts or failures of MRM. An approval should not be issued to MRM unless some mechanism is in place to ensure that its parent company Glencore is liable for rehabilitation costs. As an example, some form of parent company guarantee could be considered to avoid the problem of MRM default.

Recommendation 8: That no approval be issued without the community first being informed of and consulted about the NT Government's security bond for the site.

Recommendation 9: The EIS Response Document must include a clear case for the technical and economic viability of tailings reprocessing, especially how this may improve long-term environmental outcomes for the MRM site after the completion of all activities and rehabilitation.²

Recommendation 10: The EIS Response Document must include detailed costings for the various rehabilitation scenarios, especially the case where tailings are simply transferred from the current dam to the former pit. The detailed costings should form part of a comprehensive document outlining the financial feasibility of the project taking into account the costs associated with closure and post-closure activities.³

Project history and proponent environmental history

Recommendation 11: The EIS supplementary include a complete historical data set of all mining activity to date at MRM. The key aspects must include an annual data set of ore mined and milled, ore grades, concentrates produced, tailings generated and waste rock mined. In addition, a careful account should be provided of where all waste rock has been placed to date – including the estimated PAF and NAF quantities for each area of waste rock management.

The NOEF & SOEF

Recommendation 12: The Supplementary EIS should include the original data sets that underpin the test summaries for stability (including water retention curves) set out in the Draft EIS.

Recommendation 13: The Supplementary EIS should include tests performed for residual friction angles.

Recommendation 14: The Supplementary EIS should provide clear direction to decision makers about where long-term parameters are uncertain or based on assumptions which may prove incorrect.

Recommendation 15: The supplementary EIS should include a detailed description of the proceedings before the *Mines and Energy Review Panel* including the position of the Department of Mines and Energy vis-à-vis that of MRM which was ultimately accepted by the Panel.

² Mudd (2017) Attachment A, p 4

³ The requirement for feasibility inclusion closure to be fully set out at the earliest opportunity represents best practice, see for example The World Bank Group, Oil, Gas and Mining Policy Division *Guidance Notes for the Implementation of Financial Surety for Mine Closure*.

Limnology and the flow through mine pit lake option

Recommendation 16: That MRM include in the supplementary to the EIS a new limnology report addressing the concerns raised by Garcia and Vietz. This should include an assessment of the limitations of the current limnology assessment with regards the risks of flow through and the need for increased thoroughness of investigations of fluvial geomorphology.

Additionally those reports should details the economic assessment of each option, the EDO's clients are concerned that this option has been chosen for its economic benefits (no necessity to maintain levee wall into perpetuity and the use of levee wall clean fill) rather than its environmental or touted stakeholder acceptance benefits.

Recommendation 17: That the OBMP preferred option be changed because of the concerns addressed about the river flow through and that appropriate stakeholder engagement be conducted to inform members of the community about the new preferred approach and why river flow through is, contrary to what was said previously, presents unacceptable risks.

Ground and surface water

Recommendation 18: The supplementary EIS must outline methods to identify the extend of groundwater contamination across the MRM site and propose plans for its remediation before or during rehabilitation and site closure to ensure that environmental and cultural values are maintained.

Recommendation 19: The groundwater-monitoring plan should be amended to include bores downstream of the diversion channel.

Recommendation 20: The supplementary EIS must include all of the raw data used by MRM to substantiate their claims that sorption will effectively prevent heavy metals from polluting surface waters downstream of the Mine. Additionally, the supplementary should address concerns raised about the sorption modelling.

Recommendation 21: The supplementary EIS must address the lack of information about base lining of the NOEF with a CCL, including through the provision of detailed designs of the base lining that will need to be provided.

Recommendation 22: The supplementary EIS should provide an honest assessment of the level of confidence MRM can have in relation to the contaminant transport models.

Recommendation 23: The supplementary address the potential for contaminants to be transported by molecular diffusion.

Recommendation 24: The discrepancy in using SILO vs onsite climate data should be justified in the supplementary.

Impacts to human health and downstream flora and fauna

Recommendation 25: Exposure Assessment and monitoring of local people who consume fish and other aquatic foods should be undertaking for lead and cadmium by an independent third party at the cost of MRM.⁴

⁴ Noller (2017) Attachment D at p

Recommendation 26: a large experimental mesocosm facility needs to be set up with associated infrastructure that can be used to conduct simulate experiments and enable the exchange of tailings in water at depth and accumulations of metals over several lifetimes of short-lived aquatic species, including 10-20 years for turtle and crocodile via biopsy monitoring and biomarker techniques that do not result in mortality of the animal.

Stakeholder engagement

Recommendation 27: Visual aids in the form of photomontages should be provided to local stakeholders to give them a more accurate and realistic understanding of MRM's proposed higher NOEF option.

Recommendation 28: The supplementary draft EIS should specifically address issues which were left in a state of uncertainty following the stakeholder engagement process. Specifically, ambiguity around the pit lake and job opportunities for local people should be addressed.

Recommendation 29: Before considering whether approval is given to the OBMP, the Commonwealth Minister should require further information under s 132 about MRM's consultation with the local Indigenous clan groups about the potentially impacted MNES.⁵

Recommendation 30: Before any approval is given to the OBMP, the NTEPA and Commonwealth Environment Minister should satisfy themselves that any matters which are preconditions to the project proceeding have been entered into following the free, prior and informed consent of all relevant traditional owners.

⁵ We note that the discretion of the Minister to seek further information is a broad one, see for example *Lansen v Minister for Environment and Heritage* [2008] FCAFC 189

RISKS OUTWEIGH THE BENEFITS: THE ARGUMENT FOR REFUSING THE OBMP APPLICATION OF THE PRECAUTIONARY PRINCIPLE

The principles of ecologically sustainable development (**ESD**) are foundation principles under the EPBC Act.⁶ While not requirements of the NT environmental assessment legislation, the NTEPA is required to promote the principles of ESD.⁷ There is great uncertainty with respect to this project. Uncertainty surrounds almost every aspect of the project including, for example, long term weather and climate projections, accuracy of models and the cost of the 100 year + closure period. Our expert reports demonstrate considerable differences of opinion between appropriately qualified independent experts and MRM's consultants.

Because of the above, a particularly cautious approach is warranted. In this case, given the enormity of the challenges which are presented by managing the site in its current form the best environmental outcome can be achieved by the cessation of mining from the expiry of the current MMP and the immediate commencement of site remediation. This would include the complete backfill of the current tailings and overburden into the pit void.

The phase of mining (previously approved under phase 3) proposed by the OBMP will see an additional 575 Mt of overburden placed on the Northern Overburden Emplacement Facility (NOEF) between 2018 and 2032.⁸ This represents an almost 300% increase on the 195 Mt of material already in place on the NOEF.

We are, to some extent, dealing with a known quantity now. The site's current risks are known and – presumably – the current security bond can be utilised to offset (to a significant extend) the consequences associated with the problematic statement made by MRM in the Draft EIS at chapter 5, p 7:

Early closure of the operation (the No Project scenario) would also present an unfavourable environmental outcome.

This EIS presents detailed closure proposals for the open cut, NOEF and TSF. The success of these proposals relies on the full development of the operation. It is unlikely, considering Government positions on resource stewardship, that substantial quantities of fill would be placed in the open cut final void with a significant resource remaining within the deposit. This would preclude the preferred TSF solution of rehandling of tailings back into the open cut final void. It is more likely the site would have a prolonged period of care and maintenance waiting for management solutions or regulatory direction, which could delay the implementation of final closure works and hence increase the environmental risks during that period.

The sense one gets when reading that statement is that MRM is in essence trying to blackmail the government into approving the OBMP. This is unacceptable. Assuming the security bond is "significant" a large number of jobs can be created over the short-mid term through the commencement of rehabilitation on the site – a major project in and of itself.

Commencing rehabilitation following the expiry of the current MMP means that the environmental risks that present from the considerable uncertainties associated with the approval of the OBMP and continued mining for 20 years never eventuate. Unfortunately, the experience with this project and operator has been that continued mining results in additional problems; problems that may at some point in the future manifest in some catastrophic event or impact to the environment.

⁶ See s 3A *EPBC Act* 1999 (Cth)

⁷ s 7 *Northern Territory Environment Protection Authority Act* (NT)

⁸ See Draft EIS, table 3-26

The EDO's clients do not accept that the benefits of the project outweigh its potential risks. MRM, unsurprisingly, gives primacy to economic factors as demonstrated by the 'Project vs No Project' section of the Draft EIS where it's stated that:

*The main consequence of not proceeding with the Project would be that a globally significant base metals resource would not be developed to its full potential, with associated socio-economic benefits unrealised.*⁹

The EDO's clients do not believe that the economic benefits realised to date, or those proposed in the future are in any way sufficient to justify the impacts that have already occurred to date, that will occur in the future and those that may arise.

Particularly we note at this point the meagre number of jobs proposed for local people¹⁰, who bear the majority of the risks. We also note the following problematic statement that:

*It is assumed there is limited scope for increasing numbers of locals in skilled positions, so increases were mainly related to rehabilitation activities such as monitoring, planting, weeding and earthworks maintenance.*¹¹

Recommendation 1: That the NTEPA recommend that the OBMP be refused approval. That the responsible NT Minister and Commonwealth Environment Minister refuse approval of the OBMP.

⁹ See Draft EIS, Chapter 5, p 5-6

¹⁰ 71 jobs over 100 years (Appendix 7, p 5)

¹¹ See Draft EIS, Appendix Z, p 4

PUBLIC PARTICIPATION IN THE EIS PROCESS

Public participation is acknowledged as a critical component of the environmental impact assessment processes, both at a Commonwealth and Northern Territory level.¹² At a Commonwealth level, the inclusion of public participation requirements in the *EPBC Act* seeks to ensure Australia's compliance with a number of international agreements to which it is a party.¹³

Aside from ensuring compliance with Australia's international obligations, public participation in EIA is included because of the recognised benefits it provides, namely:

- **Better decisions** will arise where decision makers are better informed both through the provision of local knowledge and the public examination of expert knowledge;
- **Greater legitimacy of decisions** where decision makers must taken into account the views of the public, allowing all community members an opportunity to influence an outcome; and
- **Proper conduct** for public decisions made within a democratic system.

To have efficacy, however, it is not the mere existence of public participation in the EIA process, which is important, but rather, its implementation. The EDO notes clause 7.3 of the *Bilateral Agreement under s 45 of the EPBC Act* between the Commonwealth of Australia and the Northern Territory. Clause 7.3 notes specifically that:

Indigenous people affected by a proposed action may have particular communication needs, and will make arrangements to ensure that affected Indigenous people have reasonable opportunity to comment on actions assessed under this Agreement.

Awareness of the public comment period

Public awareness in Borroloola about the ability to make submissions on the Draft EIS is very low. That is a failure of the Northern Territory and Commonwealth Governments. Public notification of the kind required by the EA Act and the EPBC Act are insufficient and actively discourage public participation. We are unaware of any communication directly between members of the local community and the NT Government in relation to the Draft EIS. As far as we are aware the only consultations on the Draft EIS have been either by MRM, the Northern Land Council, the EDO and the Environment Centre NT. For a project of this magnitude - and with its potential impacts - it is a gross failure on behalf of both governments to have failed to consult the community and to inform them of their rights to participate in the EIA process.

We note that pursuant to s 8 of the *Northern Territory Environment Protection Authority Act* (NT), the NTEPA must in exercising its powers and functions must, encourage community involvement and engagement. It is difficult to see how the NTEPA has done so in this instance.

¹² See for example, *Rio Declaration on Environment and Development*
¹³

Time period for public comment

The statutory time periods for public comment are far too short. Like the inadequacy of notification of the public comment period, the period itself actively discourages public participation. Unfortunately the effect of that is to deprive decision makers of potentially valuable information and, as a corollary, increases the risk on unacceptable impacts of a project. In this case, the EDO acknowledges that the initial timeframe was extended by MRM until 17 May. Despite this extension, the timeframe allowed severely stifled our ability to provide meaningful comment and meant we were unable to obtain experts to review all elements of the Draft EIS that we had hoped to.

Under the current framework MRM has been afforded the luxury of limitless time to prepare its submission (the TOR for the OBMP were provided to MRM in 2014), whereas the EDO's clients have had to make this submission under extreme time and resource pressure. It is a grave unfairness within the current system, which places the community at a great disadvantage vis-à-vis a proponent.

In light of the incredibly complex nature of this project, its controversial history and its contentious future, the comparatively small public comment window has greatly undermined the integrity and validity of the public consultation process.

It is important for the NTEPA in preparing its assessment report to recognise that the public contribution to this process is no less valuable than that of the proponent. To that end, we suggest that both the NT Ministers (environment and *responsible* minister in NT) and the Commonwealth Minister be provided with this submission in full, particularly as it contains significant expert analysis and review of the Proponent's material. We would also request that this submission be provided to ERIAS, the Independent Monitor, who we understand is providing the NT Government (and NTEPA) with an independent review of the Draft EIS.

Recommendation 2: In view of the absence of efforts to comply with cl 7.3 to date, that prior to providing public comments to MRM for the preparation of the supplementary EIS, the NTEPA make specific arrangements for Indigenous members of the Gulf to make comment on the OBMP should they wish to.

Recommendation 3: All submissions to the Draft EIS should be made public – including (and particularly importantly) the review submission by ERIAS.

Recommendation 4: In light of the deficiencies in the process outlined above, the NTEPA and Commonwealth Minister should seek further information from local stakeholders, particularly in relation to matters of cultural significance and proposed closure planning and future land use.

Lack of available data in the draft EIS

The issues arising from lack of data availability is dealt with more specifically in relation to the relevant sections set out below, however we note in this section that expert review of the Draft EIS was not only hampered by short timeframes but also by the absence of complete data sets.

We note both the comments of David Airey in his expert report (Attachment B):

The report presents summaries of tests performed by a range of reputable organisations, however, none of the original data has been provided. It is thus impossible to assess the methodology used to perform the tests or the methods of interpretation. In my experience,

based on reviewing test reports, simply performing Australian standard tests does not guarantee the quality of the data. They need to be carefully reviewed by experienced geotechnical engineers who have a thorough understanding of soil mechanics.

...

However, it is not possible to assess the reliability of these water retention curves or their consistency with other data because only summary results are presented in Appendix N.

And Abbas El-Zein in his expert report (Attachment C):

In relation to points a and b, the EIS makes incomplete reference to two other reports, presumably providing more details on how sorption was measured. However, these reports were not provided by the consultant upon my request. Instead, a small extract (4 tables) was provided which doesn't include any discussion of the assumptions made during the measurements of K_d and seems to confirm that sorption was taken to be linear and non-competitive.

In light of the above, the Draft EIS fails to meet the requirements of s102(2)(b) of the EBPC Act, and as a consequence (unless addressed in the supplementary) the Minister will fail to ensure (as required by cl 5.04 of the *Regulations*) that the EIS addressed the matters set out in Schedule 4 of the *Environment Protection Biodiversity Conservation Regulations*, specifically:

Schedule 4(3) Relevant Impacts

(e) any technical data and other information used or needed to make a detailed assessment of the relevant impacts.

Recommendation 5: To allow greater public scrutiny and transparency, as part of the EIS supplement, MRM should include all original data sets, rather than just summaries/extracts.

LACK OF APPROPRIATE COMPLETE OPEN PIT BACKFILL SCENARIO

At various points during the Draft EIS, MRM refers to the objectives of the *Northern Territory Draft Guidelines for Mine Closure Plans* (the NT Draft MCP Guidelines).¹⁴ The EDO made comment on these draft guidelines in 2016, but we understand they are not a public document at this time. A key feature of that document was to begin from a presumption that complete backfilling of final pit voids would be required by the NT Government. Despite this, MRM does not adequately make the case for dismissing a complete backfill of the pit. Mudd, comprehensively deals with both the case for complete backfill in *The McArthur River Project: The Environmental Case for Complete Pit Backfill*¹⁵, and the deficiencies of the Draft EIS regarding complete backfill in his report (attachment A).¹⁶ We don't propose to go over that ground as it can be read in the report of Mudd and its appendices. We do draw attention again the primacy MRM has given to economic interests over environmental ones:

*This alternative would represent the greatest cost to McArthur River Mining, rendering the project uneconomic and unviable. Thus, no further operations would occur, with a consequent cessation in employment and associated community investment projects, services, taxes and royalties...*¹⁷

Additionally, when questioned about complete backfill during stakeholder engagement by MLA Gerry Wood (who noted that Ranger Uranium Mine is undertaking complete backfill), MRM responded *"It is important to remember that they were required to do that from the start so it was factored into their economics. That is not the case at MRM."*¹⁸

The context here is critical. It is MRM's historic failures, which have led to the need for this EIS. It is difficult to accept MRM continually placing economic concerns over environmental ones. The entire OBMP would, presumably, not have been a factor when MRM considered the economics of this project. Increased costs are a consequence of MRM's failures and best options should not be discounted on cost grounds alone where they have the potential for better environmental outcomes.

Recommendation 6: (Adopted from Mudd) The EIS Response Document must include a realistic scenario which ensures all PAF material is sequenced as deep as possible in the former pit. As part of the process, the broader Borroloola community must engage meaningfully in ascertaining their preferences for complete backfill – with a multi-criteria analysis or approach which properly allows for their social and environmental preference to be included as equal weight to financial or economic considerations (i.e. cost alone should not dominate rejection of the complete backfill scenario).

¹⁴ See for example Draft EIS, Chapter 4 p 4-7

¹⁵ See Mudd (2017) Appendix B

¹⁶ Mudd (2017) p 5 – 6 & Mudd. G

¹⁷ Draft EIS, Chapter 5, p 5-31

¹⁸ See Draft EIS, Appendix Y, p 73

MECHANISMS TO COMPEL COMPLIANCE WITH OBMP LOM CLOSURE PLAN

Lack of mechanisms to fund closure

The EDO's clients are not confident that MRM will see their closure plan through if the OBMP is approved. This must be one of the primary considerations for the NTEPA in preparing their assessment report and for decision makers in considering whether to approve the project. The short-term economic benefits of the project are well defined, but the long terms risks and costs are not. Importantly, the Draft EIS closure plan does not provide an estimate of costs of rehabilitation.

Decision makers should accept that – save for the security bond – there is currently no funding mechanism or hook that will keep MRM on the site financing its closure plan for (potentially 1000+ years). It would be naïve and contrary to past experience to expect social conscience and social licence to keep MRM on the site for a period of up to 1000 years. Historical experience with the mining industry generally does not support a conclusion that MRM will stay and fulfil its closure obligations.¹⁹ Therefore, decision makers should proceed on the basis that taxpayers will be liable for closure costs once the productive life of the mine is at an end.

Decision makers should be aware that the NT does not have chain of responsibility legislation of the kind found in QLD.²⁰

Recommendation 7: The Supplementary should specifically address the issue that Glencore (MRM's parent company) is unlikely to bear liability for acts or failures of MRM. An approval should not be issued to MRM unless some mechanism is in place to ensure that its parent company Glencore is liable for rehabilitation costs. As an example, some form of parent company guarantee could be considered to avoid the problem of MRM default.

Security bond under the MMA

At various points throughout the Draft EIS, MRM makes positive statements about the sufficiency of its security bond provided pursuant to s 43 of the *Mining Management Act*.²¹ The issue of the MRM security was raised during the consultation process with MRM noting that community members were concerned about the level of security held for the site.²²

The EDO's clients take small comfort from MRM's assurances that the security bond is sufficient and would feel far better if MRM instead chose to be transparent about how much the Government holds. Nevertheless, it is difficult to see how the government could be holding a bond sufficient to cover the potentially 1000 years of rehabilitation and monitoring – indeed it is unclear how a bond of that nature could even be calculated. To exemplify the difficulty of that task, consider the ability to predict the costs of an excavator in the year 2000 in 1900. It would have been practically impossible. It is even less feasible to predict what costs might be 1000 years from now.

It is difficult to reconcile MRM's statements about economic viability – for example in relation to backfilling the void – and their commitment to stay on the site for potentially 1000 years, some 980 years post the end of commercial exploitation of the ore body.

¹⁹ See for example, Mineral Policy Institute (2016) *Ground Truths: Taking Responsibility for Australia's Mining Legacies*

²⁰ See *Environment Protection (Chain of Responsibility) Act 2016* (QLD)

²¹ See for example, Draft EIS Appendix Y, p 64

²² See for example, Draft EIS Appendix Y, p 41 & 64

Further we note that Dr Mudd describes the long-term monitoring as “conceptual at best, especially given the lack of detailed water quality criteria against which to assess and judge potential impacts”²³.

While the EDO’s clients support the extraction and placement of tailings in the pit after the completion of mining (whether that occurs in 2018 without approval of the OBMP or later if approved) we note the concerns raised by Professor Mudd in relation to the economic viability of tailings reprocessing.²⁴ These concerns raise additional alarm bells about MRM’s capacity/ability/desire to “stay the course” if the OBMP is approved.

Recommendation 8: That no approval be issued without the community first being informed of and consulted about the NT Government’s security bond for the site.

Recommendation 9: (Adopted from Mudd – Attachment A) The EIS Response Document must include a clear case for the technical and economic viability of tailings reprocessing, especially how this may improve long-term environmental outcomes for the MRM site after the completion of all activities and rehabilitation.²⁵

Recommendation 10: (Adopted from Mudd – Attachment A) The EIS Response Document must include detailed costings for the various rehabilitation scenarios, especially the case where tailings are simply transferred from the current dam to the former pit. The detailed costings should form part of a comprehensive document outlining the financial feasibility of the project taking into account the costs associated with closure and post-closure activities.²⁶

²³ Mudd (2017) Attachment A

²⁴ We note that MRM has said that closure plan is not conditional upon reprocessing – see Appendix Y

²⁵ Mudd (2017) Attachment A, p 4

²⁶ The requirement for feasibility inclusion closure to be fully set out at the earliest opportunity represents best practice, see for example The World Bank Group, Oil, Gas and Mining Policy Division *Guidance Notes for the Implementation of Financial Surety for Mine Closure*.

OVERBURDEN CHEMISTRY / MATERIALS CHARACTERISATION

The Draft EIS demonstrates a significant improvement in the categorisation of materials that form the overburden on the site. Various experts engaged by the EDO's clients have noted the generally high quality of the geochemical work, which has been undertaken by MRM.²⁷ Despite this we note that previous (recent) history shows that MRM's track record is poor with regard to the assessment of waste rock characterisation and acid mine drainage issues.

Noller does make note of uncertainties, particularly regarding the underestimating of acid generation risk on the site, however, his review was generally complimentary of the work done by MRM in the geochemical section of the Draft EIS. Despite this he concludes that good management of the overburden will be critical to ensure that water materials are not dispersed by water or air.²⁸

Additionally, Noller notes that the systems and resources required to undertake monitoring over the post closure phases must be planned and allocated as part of the closure process.²⁹

Poor detail of the Mine's history

Because of the above and specifically low levels of confidence in previous work done by MRM, issues were raised with the way the Draft EIS presents (or fails to present) information in relation to the site's history.³⁰ Particularly the Draft EIS almost completely ignores the history of failure by MRM that has necessitated this project. Professor Gavin Mudd, in his report (Attachment A) states the following:

The lack of any meaningful presentation and discussion of the environmental history of MRM at the start of Chapter 3 effectively avoids the reasons why there needs to be an entire EIS on just managing overburden (or waste rock) at the site (I know of no other mine in Australia which has been required to produce an EIS for this aspect of mining alone) – and perhaps most critically avoids the reality that the project has consistently under-estimated the proportion of potentially acid-forming (PAF) mine wastes. A careful examination of this history also shows that (briefly summarised from Mudd, 2016):

Understanding the history of the site and the previous *modus operandi* of MRM is critical to the forming of an opinion about the current project and whether it should be approved and if so, subject to what conditions. Indeed it is a requirement for the Commonwealth Minister to consider *environmental history* of the proponent in deciding whether or not to approve the project.³¹

The current Draft EIS tends to gloss over the past and provides a misleading impression of the developments, which have led to this EIS process.

Recommendation 11: (Adopted from Mudd – Attachment A): The EIS supplementary include a complete historical data set of all mining activity to date at MRM. The key aspects must include an annual data set of ore mined and milled, ore grades, concentrates produced, tailings generated and waste rock mined. In addition, a careful account should be provided

²⁷ See Mudd (2017) Attachment A & Noller (2017) attachment D

²⁸ Noller (2017) Attachment D, p 14

²⁹ Noller (2017) Attachment D, p 15

³⁰ We note that the Terms of Reference for the Draft EIS require '*History of the development of the McArthur River Mine to Date* and the *Environment Protection and Biodiversity Conservation Regulations, Schedule 4* requires that statements include details about the background of the action.

³¹ See s 136(4) EPBC Act (Cth)

of where all waste rock has been placed to date – including the estimated PAF and NAF quantities for each area of waste rock management.

Poor explanation of ‘Low Capacity’ or ‘High Capacity’ Mine Wastes

We draw attention to the discussion of Dr Mudd, at 2.3 of his report where he discusses the deficiencies in the descriptions of high or low capacity waste. We particularly note the limited utility of this definition given the statement in the EIS (raised by Mudd) that: *In practice, the segregation of MS-NAF(LC) from MS-NAF(HC) is unlikely to be possible most of the time. Both material classes have similar geochemical properties and will require mitigation, so this has little effect on the architecture of the NOEF.*³²

³² Mudd (2017) Attachment A

NOEF STABILITY AND DESIGN

Our comments on the stability and design of the NOEF are drawn from the comments of Professor David Airey (Attachment B). Airey notes that “any analysis is only as good as the input parameters and this is where I have some concerns”.

The Draft EIS presents summaries of tests performed but does not include original data. Unfortunately this has limited the ability for Professor Airey to meaningfully review the Draft EIS.

Professor Airey raises a primary concern with Figure 13 in Appendix N to the Draft EIS. His concern relates to a plot showing peak friction angle against “cohesion”. Professor Airey notes “most clays do not have any true cohesion...the correct terminology should have been apparent cohesion”.³³ This is a critical point because the stability of the NOEF will be reliant on the “apparent cohesion” caused by a combination of soil expansion and pore water suctions.

Professor Airey notes that:

*The reason why this is critical is that the stability of the steeper part of the slope of the NOEF relies on the “apparent” cohesion. It can be shown by a simple infinite slope analysis with a failure plane running along the CCL layer that the factor of safety increase from 1 to 1.5 is due to the apparent cohesion. If the cohesion is assumed to be zero the factor of safety will be one, that is the CCL will be on the verge of failure, and this would represent an unacceptable risk on any critical slope.*³⁴

Airey further notes that:³⁵

- MRM do not appear to have performed tests on their assessment of residual friction angle.
- There is a risk that local sections of the high upper slopes of the NOEF could fail.
- MRM fails to acknowledge the inherent uncertainty of the long-term stability of the NOEF slopes. Airey states there is “considerable risk” attached to MRM’s apparent assumption that base drainage will continue to function effectively until 3017.
- There is inconsistency between the water retention curves and assumed strength parameters.

Recommendation 12: The Supplementary EIS should include the original data sets that underpin the test summaries for stability (including water retention curves) set out in the Draft EIS.

Recommendation 13: The Supplementary EIS should include tests performed for residual friction angles.

³³ Airey (2017), Attachment B

³⁴ Airey (2017) Attachment B

³⁵ Airey (2017) Attachment B

Recommendation 14: The Supplementary EIS should provide clear direction to decision makers about where long term parameters are uncertain or based on assumptions which may prove incorrect.

THE SOEF

The EDO has previously raised concerns with the government about the determination of the *Mines and Energy Review Panel* with respect to the Southern Overburden Emplacement Facility (SOEF). Those concerns remain.

We note the errors during 2016 where “63 truckloads of PAF” were placed incorrectly on the SOEF.³⁶

Recommendation 15: The supplementary EIS should include a detailed description of the proceedings before the *Mines and Energy Review Panel* including the position of the Department of Mines and Energy vis-à-vis that of MRM which was ultimately accepted by the Panel.

³⁶ See Draft EIS, Chapter 3 at p 3-94

LIMNOLOGY & FLOW THROUGH MINE PIT LAKE

MRM presents the ‘*flow through mine pit lake as secondary option*’ as their preferred alternative. MRM states that this design will achieve a “higher level of stakeholder acceptance” than the isolated void originally proposed in Phase 3.³⁷ MRM have chosen to present this option as the preferred one because they see it as having the following key advantages:

- Mine pit lake water dilution is decreased (relative to Alternative 3), with periodic flushing of the mine pit lake by flood waters only;
- Mine pit lake water will be relatively stable, though not as stable as Alternative 3 in low flow years;
- Reduced sediment deposition in the mine pit lake as compared to Alternative 3;
- Engineered inlets on the upstream and downstream side of the mine pit lake can be constructed and maintained to function as intended;
- The bulk of the mine levee wall would not need to be functional after breaching;
- The excavated levee material could be used as a source of clean fill in rehabilitating other areas;
- Higher degree of acceptance to stakeholders;
- Self-sustaining; and
- Under low-flow conditions, evaporative loss from the mine pit lake does not limit downstream flows in the McArthur River.

The EDO’s clients’ express serious reservations about the flow through mine pit lake approach. To them, it is not an option that increases acceptability of the project. Indeed we question MRM’s approach to stakeholder engagement around this issue generally (discussed in more detail below). The EDO’s clients concerns about the flow through are backed up by the views of the scientific experts engaged by the EDO’s clients.

Dr Erica Garcia (Attachment F) raises concerns about the “high potential” for tailings to move from storage into downstream parts of the river. Garcia references the discussion in the *Final Void Limnology Assessment Report* where it is conceded that constant low level mixing and periods of high mixing (of contaminants/sediments and surface water) will occur.

Dr Geoff Vietz (Attachment E) shares Garcia’s concerns with the flow through of the mine pit lake. Noting variously that:

- *The redirection of the McArthur River through the mine tailings could impact on bedload sediment transport conveyance from the McArthur River upstream of the mine pit lake to downstream of the mine pit lake.*
- *Diverting flow through the pit is likely to lead to deposition of sediments and aggradation in the upper reaches of the diversion channel.*
- *Risk the channel could capture the river’s entire flow at times, leading to erosion issues in the diversion channel.*

Furthermore, Garcia notes that the flow through mine pit lake option introduces a non-typical new habitat into the river ecosystem, which may present unknowable or unanticipated negative impacts on the system. It is unclear why these risks were not raised specifically and in detail with stakeholders during consultation.

Garcia concludes “*the possible negative consequences to the McArthur River food web and those that rely on the food web by re-establishing the original path through the pit lake could*

³⁷ Draft EIS, Chapter 5 *Project Alternatives*, p 5-5

be catastrophic and long-lasting". Vietz notes that the risks associated with the flow through can be avoided by simply not doing it. In light of the above comments it is difficult to justify why this option is the preferred option.

Recommendation 16: That MRM include in the supplementary to the EIS a new limnology report addressing the concerns raised by Garcia and Vietz. This should include an assessment of the limitations of the current limnology assessment with regards the risks of flow through and the need for increased thoroughness of investigations of fluvial geomorphology.

Additionally those reports should details the economic assessment of each option, the EDO's clients are concerned that this option has been chosen for its economic benefits (no necessity to maintain levee wall into perpetuity and the use of levee wall clean fill) rather than its environmental or touted stakeholder acceptance benefits.

Recommendation 17: That the OBMP preferred option be changed because of the concerns addressed about the river flow through and that appropriate stakeholder engagement be conducted to inform members of the community about the new preferred approach and why river flow through is, contrary to what was said previously, presents unacceptable risks.

GROUND & SURFACE WATER

Our submissions in relation to ground and surface water are primarily based on the expert input of Professor Abbass El-Zein and Dr Gavin Mudd. Professor El-Zein raises “serious concerns” about the approach taken by MRM in the Draft EIS to ensure the protection of water (both surface and ground) from contaminants. Dr Mudd raises concerns about modelling, climate data, background levels and surface water quality.

In summary those concerns are:

- An difficulty in discerning background or baseline groundwater chemistry.
- Over-reliance on sorption without consideration of competition, non-linearity and pH sensitivity. This, according to Professor El-Zein is important because *“if sorption has been overestimated, the actual concentrations of heavy metals may be orders of magnitude larger than those predicted in the EIS and may travel manyfold further than estimated in the document”*.³⁸
- Paucity of information about base lining.
- Weaknesses in the contaminant transport numerical model. According to Professor El-Zein, *“confidence in predictions of the contaminant transport model, based on evidence provided in the EIS, must be considered low”*. We note that particular issue is taken with MRM’s consultant’s statement that *“flow boundaries have been kept consistent i.e., the flow model and the contaminant transport models boundary conditions for the flows are identical”*. According to Professor El-Zein this does not make “scientific sense”. According to Professor El-Zein, the weaknesses in this numerical model raise serious concerns about the future risks to water quality.³⁹
- Lack of consideration of molecular diffusion as a contaminant transport mechanism.
- Discrepancy between climate data source SILO and onsite data – particularly regards rainfall.

Our recommendations below are informed by the comments of Professor El-Zein and Dr Gavin Mudd. We note that additional information sought from MRM was not provided and this has hampered Professor El-Zein’s ability to perform the review requested of him.

Recommendation 18: (Adopted from Mudd) The supplementary EIS must outline methods to identify the extend of groundwater contamination across the MRM site and propose plans for its remediation before or during rehabilitation and site closure to ensure that environmental and cultural values are maintained.

Recommendation 19: (Adopted from Mudd) The groundwater monitoring plan should include bores downstream of the diversion chanel.

Recommendation 20: The supplementary EIS must include all of the raw data used by MRM to substantiate their claims that sorption will effectively prevent heavy metals from polluting surface waters downstream of the Mine. Additionally, the supplementary should address concerns raised about:

³⁸ El-Zein (2017), Attachment C, p 3

³⁹ El-Zein (2017), Attachment C, p 5

- (a) the apparent absence of *non-linear* modelling of sorption for the Site in circumstances where sorption has been overestimated in similar conditions;
- (b) competition for sorption sites given the presence of multiple contaminants at the Mine;
- (b) the potential variations over time which may impact on the soil's capacity for sorption; and
- (c) the lack of consideration of desorption.

Recommendation 21: The supplementary EIS must address the issues raised by Professor El-Zein with regards to lack of information about base lining of the NOEF with a CCL, including through the provision of detailed designs of the base lining that will need to be provided.

Recommendation 22: The supplementary EIS should provide an honest assessment of the level of confidence MRM can have in relation to the contaminant transport models. Specifically, the supplementary must enable the NTEPA and decision makers to be in a position to assess the risks associated with calibration issues, short time interval models for contaminant transport models, the lack of modelling of heavy metals present in soil and the lack of boundary conditions.

Recommendation 23: The supplementary address the potential for contaminants to be transported by molecular diffusion.

Recommendation 24: (Adopted from Mudd) The discrepancy in using SILO vs onsite climate data should be justified in the supplementary. The EDO notes historical issues with MRM's consideration of climate change impacts, raised by the Independent Monitor.⁴⁰

PROTECTION OF HUMAN HEALTH & DOWNSTREAM FLORA AND FAUNA

It was beyond the scope of our expert review to determine whether adequate protection of human health and downstream flora and fauna impacts are provided for by the Draft EIS. However, our experts have made a number of recommendations in this regard. Particularly concerns were expressed about the way testing is occurring for offsite and downstream water quality, human health impacts and impacts to flora and fauna.

We particularly raise the following issues:

- Using guideline values is not a credible method for assessing the effects of contaminants on organisms. That is, it shouldn't be assumed that just because a contaminant doesn't exceed a guideline value for sediment or water that the contaminant is not having an effect on organisms. Noller notes: "*for aquatic species such as fish and invertebrates contaminants in the food chain may effect particular species in the food chain and not be detected by physico-chemical monitoring*"⁴¹
- There is no direct monitoring of the exposure of the local population for heavy metal intake.

In light of the above we make the following recommendations:

⁴⁰ See Mudd (2017) Attachment A, p 7 and Part 1 of the Independent Monitor Audit Report 2015

⁴¹ Noller (2017) Attachment D at p 24

Recommendation 25: (Adopted from the report of Noller) Exposure Assessment and monitoring of local people who consume fish and other aquatic foods should be undertaken for lead and cadmium by an independent third party at the cost of MRM.⁴²

Recommendation 26: (Adopted from the report of Noller) a large experimental mesocosm facility needs to be set up with associated infrastructure that can be used to conduct simulate experiments and enable the exchange of tailings in water at depth and accumulations of metals over several lifetimes of short-lived aquatic species, including 10-20 years for turtle and crocodile via biopsy monitoring and biomarker techniques that do not result in mortality of the animal.

MRM'S CONSULTATION ON THE OBMP & SOCIAL MATTERS MORE GENERALLY

When making an approval decision, the Minister (or delegate) must consider social matters.⁴³

The Draft EIS does not provide adequate information for the Minister to assess the social impacts of the OBMP and the Mine more generally. In considering whether to grant approval the Minister's ability to consider social matters is very broad, as is the weight he might place upon those matters. In this case, the Mine's potential to adversely impact the social fabric of the community is clear. It is evident from the clear divergence of opinions about the Mine and about its future.

Because of the mine's potential impacts on not only the site but the surrounding areas and downstream mean that the future of the Mine should be decided in consultation with all four clan groups. The Draft EIS should directly address issues of community divisions and social cohesion and what strategies they have in place to directly involve all clan groups in decision-making. This has not occurred.

The EDO's clients make the following points in relation to consultation undertaken in relation to the OBMP:

- The stakeholder consultations with all four clan groups cannot be considered best practice and fail to meet the standards required under Australia's international obligations for extractive industry projects working in regions populated by Indigenous people. To the extent that the Draft EIS is relied upon by a government-decision maker, additional consultation will be required to meet Australia's international obligations.⁴⁴
- There are a number of flaws in the consultation process undertaken by MRM. Firstly, the framework under which the consultation too place is unclear and appears not to properly distinguish between consultation with communities generally and the level of consultation required to meet the test of free, prior and informed consent of Indigenous communities.⁴⁵ Among the requirements for effective consultation

⁴² Noller (2017) Attachment D at p

⁴³ s 136(1)(b) *EPBC Act* 1999 (Cth)

⁴⁴ The obligations of the Australian state to ensure effective consultation with Aboriginal people originates in international law from, inter alia, the *Declaration on the Rights of Indigenous Peoples* (DRIP). The Australian Government on 3 April 2009 announced its support for the DRIP. See the following relevant articles, 18, 19, 25, 27, 29 and 32.

⁴⁵ We note that MRM claims its policy and approach aligns with the International Council of Mining and Metals' 'Position statement on indigenous peoples and mining' (May 2013), which sets out its members' approaches to engaging with indigenous peoples, and to free, prior and informed consent.⁴⁵

developed through international standards is the requirement to include Aboriginal people in the development of consultation processes themselves. It does not appear this was done in this case.

- The consultation plan does not demonstrate that MRM has adequately addressed power imbalances between it and the local community through the provision of resources including, financial assistance, interpreters, independent legal representation and independent technical assistance.⁴⁶
- While traditional owners were questions regarding the particular land on which the mine is located, it does not appear from the stakeholder engagement report that members of all four clan groups were asked about nationally significant environmental matters, or culturally significant matters. Rather it appears it has been assumed that mainstream legal frameworks (in the form of EIA legislation) sufficiently identifies and deals with those risks.
- The EIS identified that “employment and training opportunities” presented during consultation sessions form part of the “significant support” for the project.⁴⁷ However, there were contradictory statements made regarding the likelihood of employment, and the nature of any employment. The EIS reports an employment target of 20%, however these jobs appear to be limited in skill levels and may not reflect a genuine transition for many to skilled jobs. For example, the Economic Impacts Assessment Report contained in Appendix Z (page 4) assumes there will be limited scope for employing locals and skilled positions and presupposes that increases in employment will be mainly related to rehabilitation activities such as monitoring, planting, weeding and earthworks maintenance." This is reiterated in Chapter 12 (pages 12–33) which states that during Stage Three (decommissioning and rehabilitation): "there will not be the same demand for skilled construction workers. During this period McArthur River mining has plan for approximately 11 positions to be held by local indigenous residents".

Firstly, it is not clear what the basis is for the assumption that local Aboriginal residents should be limited to unskilled positions in circumstances where the plan is presupposing a commitment of the company to the mine for a number of years. For instance, MRM would be in a position to offer scholarships to local indigenous students who wish to take up environmental science, mechanical engineering, or management degrees and could complete their degrees well within time for the decommissioning efforts. Secondly, a number of comments by stakeholders during the consultation (as recorded in the stakeholder consultative report) suggest a potentially exaggerated understanding, or belief, in the number of jobs that will likely arise from the Project. It is difficult to read the comments in the stakeholder report

According to that statement, one of the indicia of free, prior and informed consent is that "*indigenous peoples can give or withhold consent to a project, through a process that strives to be consistent with their traditional decision-making processes while respecting internationally recognised human rights and is based on good faith negotiation*".⁴⁵ Members of the Council also commit to implementing 10 principles arising from that position statement, including relevantly, principle 3, to “respect human rights and the interests, cultures, customs and values of employees and others affected by our activities (International Council on Mining & Metals, *Position Statement on Indigenous Peoples and Mining* (2013) p.3

⁴⁶ Given the highly technical nature of the project, it is appropriate that the four clan groups be provided with resourcing to access independent experts to review the methodologies and conclusions contained in the Draft EIS.

⁴⁷ Draft EIS, Appendix Y, p 42.

about an increase in local jobs and focus on local workers as consistent proposed. Given the often general and vague language used in the report, in our view it is likely that community members demonstrating commitment to the project because of its potential to add jobs may be operating under a misapprehension as to how many jobs are likely to be added. Additionally, the report contains a series of aspirational statements rather than actual commitments around employment and training.⁴⁸

- The plan to run the river back through the pit lake was poorly explained and it appears from the stakeholder engagement report that significant confusion remains within the community about this aspect of the Draft EIS. During consultations, stakeholders suggested that the lake might be used for such things as agriculture and recreation and were told that would be explored further. However, elsewhere in the Draft EIS it is confirmed that there would not be access to the pit lake, or that it could be used as a water source. There is not evidence to suggest that this was ever clarified with stakeholders.

Recommendation 27: Visual aids in the form of photomontages should be provided to local stakeholders to give them a more accurate and realistic understanding of MRM's proposed higher NOEF option.

Recommendation 28: The supplementary draft EIS should specifically address issues which were left in a state of uncertainty following the stakeholder engagement process. Specifically, ambiguity around the pit lake and job opportunities for local people should be addressed.

Recommendation 29: Before considering whether approval is given to the OBMP, the Commonwealth Minister should require further information under s 132 about MRM's consultation with the local Indigenous clan groups about the potentially impacted MNES.⁴⁹

The Agreement in relation to the height of the waste rock dump

This is not a matter that specifically concerns the EDO's clients. However, the EDO's clients - in taking issue with MRM's consultation processes more broadly - feel compelled to raise the questionable legitimacy of the purported agreement with traditional owners in relation to the raising of the height of the waste rock dump.

As discussed above, there is a significant power imbalance that exists between the local community and MRM (owned by multinational Glencore). Because of this it is incumbent upon MRM to ensure that stakeholders understand their rights and achieve free, prior and informed consent. This should be achieved by allowing sufficient time for consideration, by providing local stakeholders with independent legal representation and ensuring that interpreters are provided where necessary. As noted above, this is important in general consultation but it is even more critical when making agreements with traditional owners and members of local stakeholder groups.

It is far from clear whether MRM followed those processes and if they have not it raises real questions as to the legitimacy of MRM's agreement and indeed whether the agreement can be regarded as an *unconscionable contract*.

⁴⁸ Draft EIS, Appendix Y, p 42

⁴⁹ We note that the discretion of the Minister to seek further information is a broad one, see for example *Lansen v Minister for Environment and Heritage* [2008] FCAFC 189

Recommendation 30: Before any approval is given to the OBMP, the NTEPA and Commonwealth Environment Minister should satisfy themselves that any matters which are preconditions to the project proceeding have been entered into following the free, prior and informed consent of all relevant traditional owners.

A handwritten signature in black ink, appearing to read 'David Morris', with a stylized flourish extending to the right.

David Morris
Principal Lawyer
Environmental Defenders Office NT
17 May 2017

Appendix 3 – Assessment of other environmental factors

Environmental Factor	Description of the Proposal's potential impacts on the environmental factor	Evaluation of why the factor is not a key environmental factor
Marine Environmental Quality Objective: Maintain the quality and productivity of water, sediment and biota so that environmental values are protected	Impacts to marine environmental quality could occur as a result of the Proposal if a catastrophic failure of the TSF occurred prior to the transfer of tailings to the open pit (from 2036). This is addressed in section 5.1 of this report.	Marine environmental quality not identified as a preliminary key environmental factor for this assessment. Having regard to the following: <ul style="list-style-type: none"> the NT EPA has recommended periodic review of tailings deposition practices and embankment stability, by a panel of independent experts. The NT EPA considers that, with the implementation of recommendations in this report, the potential impacts to marine environmental quality could be effectively prevented to meet the NT EPA's environmental objective.
Terrestrial environmental quality Objective: Maintain the quality of land and soils so that environmental values are protected	Terrestrial environmental quality may be impacted as a result of the Proposal by soil contamination resulting from potential acid and metalliferous drainage (AMD) resulting from waste rock, tailings or ore.	Terrestrial environmental quality was not identified as a preliminary key environmental factor for this assessment. Having regard to the following: <ul style="list-style-type: none"> soil contamination resulting from leachate from waste storages has been addressed in section 5.1 (Inland water environmental quality). The NT EPA considers that, with the implementation of recommendations in this report, the potential impacts to terrestrial environmental quality could be effectively prevented, managed or mitigated to meet the NT EPA's environmental objective.

Environmental Factor	Description of the Proposal's potential impacts on the environmental factor	Evaluation of why the factor is not a key environmental factor
<p>Landforms</p> <p>Objective: Conserve the variety and integrity of distinctive physical landforms so that environmental values are protected</p>	<p>Impacts to landforms could occur through the following activities as a result of the Proposal, if is implemented:</p> <ul style="list-style-type: none"> • Significant enlargement of the permanent waste storage facility (NOEF). • Enlargement of the permanent open-pit. 	<p>Landforms were not identified as a preliminary key environmental factor for this assessment.</p> <p>Having regard to the following:</p> <ul style="list-style-type: none"> • potential impacts to the aesthetic and cultural aspects of the environment relating to a distinctive landform (sacred site) adjacent to the MRM site have been addressed in section 5.4 (social, economic and cultural surroundings) • the NOEF would be visible from the Carpentaria Highway. This is unlikely to be considered significant on a regional, Territory or national scale • the intended land use of the MRM site and surrounding area after cessation of mining activities is broad-scale pastoralism that would not be significantly affected by the presence of non-natural landforms including the NOEF and open pit. <p>The NT EPA considers that, with the implementation of recommendations in this report, the potential impacts to landforms could be effectively prevented, managed or mitigated to meet the NT EPA's environmental objective.</p>

Environmental Factor	Description of the Proposal's potential impacts on the environmental factor	Evaluation of why the factor is not a key environmental factor
<p>Air quality and greenhouse gases</p> <p>Objective: Maintain air quality and minimise emissions and their impact so that environmental values are protected</p>	<p>Potential impacts to air quality and greenhouse gas (GHG) emissions could occur through the following activities as a result of the Proposal, if is implemented:</p> <ul style="list-style-type: none"> • Clearing of vegetation. • Spontaneous combustion of waste rock or tailings causing emissions of sulphur dioxide. • An additional 11 years of GHG and other air emissions due to fuel combustion for power generation, vehicle use, and the transport of materials and employees (at a lower rate than the previously approved Phase 3 development until 2036). • Dust generated by the transport or processing of ore. 	<p>Air quality and greenhouse gases were not identified as a preliminary key environmental factor for this assessment.</p> <p>Having regard to the following:</p> <ul style="list-style-type: none"> • the total area to be cleared for the Proposal (as indicated by the maximum disturbance area) is less than the area approved to be cleared for the Phase 3 development. • additional emissions of GHG and other substances from fuel combustion would be unlikely to be significant on a national scale • the implementation of the Dust Management Plan would minimise the generation and mobilisation of dust and impacts on sensitive receptors • the risk of spontaneous combustion would be reduced by the implementation of measures outlined in the Proposal and recommendations made in this report. <p>The NT EPA considers that it is unlikely that the proposal would have a significant impact on Air Quality and Greenhouse Gases and this factor can be managed to meet the NT EPA's environmental objective.</p>

Appendix 4 – Principles of Ecologically Sustainable Development

Under the NT EPA Act, ecologically sustainable development (ESD) means using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life now and in the future can be increased.

In December 1992, the Territory Government endorsed the 'National Strategy for Ecologically Sustainable Development' and agreed, along with all other States and Territories, to the 'Intergovernmental Agreement on the Environment' (IGAE).

The NT EPA uses the four principles contained in the IGAE to demonstrate that it has considered ESD in its assessment of the Proposal and in its fulfilment of its objectives under the NT EPA Act.

ESD principle	NT EPA assessment
<p>1. The precautionary principle</p> <p><i>Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.</i></p> <p><i>In application of this precautionary principle, decisions should be guided by:</i></p> <ul style="list-style-type: none"> a) <i>careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and</i> b) <i>an assessment of the risk-weighted consequences of various options.</i> 	<p>In considering this principle, the NT EPA notes that Inland Waters Environmental Quality; Hydrological Processes; Aquatic Ecosystems; Social, Economic and Cultural Surroundings and Human Health could be significantly impacted by the Proposal. The assessment of these impacts is provided in this report.</p> <p>Investigations into the biological, physical and cultural environment undertaken by the proponent have provided sufficient scientific certainty to enable assessment of the risks and potential impacts and to identify measures to avoid or minimise those impacts and risks. The NT EPA has made recommendations to ensure these measures are implemented by the proponent. In particular, the NT EPA has made recommendations concerning adaptive management and the establishment of independent expert panels to further reduce scientific uncertainties inherent in the Proposal.</p> <p>From its assessment of the Proposal, the NT EPA has concluded that if its recommendations are imposed as conditions on the implementation of the Proposal, there is no threat of serious or irreversible damage.</p>
<p>2. The principle of intergenerational equity</p> <p><i>The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations.</i></p>	<p>The NT EPA notes that the proponent has taken measures to avoid and minimise impacts of the Proposal on the environment. Additionally, the NT EPA has made recommendations to manage impacts to the key environmental factors identified during the course of this assessment.</p> <p>In particular, the NT EPA has recommended that the overarching environmental outcome of protecting the McArthur River's environmental values from mine-related impacts along its entire length all of the time be the primary consideration for management.</p> <p>From its assessment of this Proposal, the NT EPA has concluded that provided its recommendations</p>

	are imposed as conditions on the implementation of the Proposal, environmental values will be protected and that the health, diversity and productivity of the environment will be maintained for the benefit of future generations.
<p>3. The principle of the conservation of biological diversity and ecological integrity</p> <p><i>Conservation of biological diversity and ecological integrity should be a fundamental consideration.</i></p>	<p>In considering this principle, the NT EPA notes that the Proposal will result in impacts and risks to Inland Waters Environmental Quality, Hydrological Processes and Aquatic Ecosystems. In assessing this proposal, the NT EPA has considered these impacts and risks and taken into consideration measures proposed by the proponent to avoid and minimise impacts to the affected values.</p> <p>From its assessment of this proposal the NT EPA has concluded that provided its recommendations are imposed as conditions on the implementation of the proposal, the proposal will not compromise the biological diversity and ecological integrity of the affected areas.</p> <p>In particular, the NT EPA has recommended that the overarching environmental outcome of protecting the McArthur River's environmental values from mine-related impacts along its entire length all of the time be the primary consideration for management.</p>
<p>4. Principles relating to improved valuation, pricing and incentive mechanisms</p> <p><i>a) Environmental factors should be included in the valuation of assets and services.</i></p> <p><i>b) The polluter pays principles – those who generate pollution and waste should bear the cost of containment, avoidance and abatement.</i></p> <p><i>c) The users of goods and services should pay prices based on the full life-cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste.</i></p> <p><i>d) Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structure, including market mechanisms, which enable those best placed to maximise benefits and/or minimize costs to develop their own solution and responses to environmental problems.</i></p>	<p>In considering this principle, the NT EPA notes that the Proponent will take responsibility for preventing waste and pollution, and that mine closure and rehabilitation and ongoing management of the Proposal would be the responsibility of the Proponent. Furthermore, the NT EPA has also made a recommendation concerning the security bond for the mine.</p> <p>The NT EPA has had regard to this principle during the assessment of the proposal.</p>