

Environmental Management Plan – Former Rum Jungle Mine Site

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Acronyms	
The following acronyms are used in this document	
Acronyms	Full form
AAEC	Australian Atomic Energy Commission
DME	Department of Mines and Energy
EMP	Environmental Management Plan
EPA	Environmental Protection Authority
FMEA	Failure Modes Effects Analysis
FRLT	Finniss River Lands Trust
IAEA	International Atomic Energy Agency
LDWQO	Locally-derived water quality objectives
NEPM	National Environment Protection Measure
NT	Northern Territory
TEP	Territory Enterprise Pty Ltd
TO	Traditional Owners
WRD	Waste Rock Dumps

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1. Introduction

This Environmental Management Plan (EMP) outlines the strategy for the Rum Jungle rehabilitation project for managing, monitoring and assessing of all environmental risks associated with proposed activities, before, during and after construction.

The structure of this EMP was established in accordance with the requirements for the development and presentation of management plans under the *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) conditions of approval, and also based on the best practice Northern Territory Government Environmental Protection Agency (NT EPA) *Guidelines for Preparation of Management Plans (2012)*, and the Commonwealth Government Department of Environment's *Environmental Management Plan Guidelines (2014)*.

The EMP is the principal document that outlines the commitment to environmental management during the implementation of the rehabilitation project by identifying the objectives, management measures, monitoring requirements and assessment criteria.

The various environmental management elements incorporated into the EMP are divided into key management plans based on environmental risks and proposed activities. Potential impacts and risks to the environment are considered in each management plan and detailed strategies to manage and monitor them outlined for all phases of the work.

Key management principles are summarised in the main EMP and each individual management plan will detail the implementation strategy for each major element that presents a significant risk as part of the overall environmental management framework.

This EMP identifies the high-risk environmental aspects of implementing the rehabilitation project. The EMP provides:

- A coordinated and comprehensive approach to reducing or mitigating potential environmental and community impacts during all phases of the project works.
- Practical guidance to enable contractors to measure compliance with the site's environmental requirements and to identify corrective actions where monitoring indicates an issue.
- A due diligence approach to environmental management with the tools for identifying and implementing best practice environmental standards.
- Effective mechanisms for handling issues and complaints.

1.1 Rum Jungle – project description

Rum Jungle is located within the Coomalie Shire of the Northern Territory, 105 km (by road) south of Darwin and 5 km to the northwest of the town of Batchelor. The 650 ha site is within the Pine Creek bioregion, a part of Australia's tropical savannahs, it consists mainly of eucalypt and riparian woodlands, vine forests, grasslands and wetlands. The site is on relatively elevated ground, bisected by ephemeral wet season streams that feed into the East Branch of the Finnis River. The East Branch joins the Finnis River approximately 8 km downstream of the site. The Finnis River then flows west for about 60 km before emptying into Fog Bay.

The land surrounding Rum Jungle comprises freehold leases, pastoral land, traditionally owned land and mineral titles. Rum Jungle is located on Section 2968, Hundred of Goyder, and is classified as vacant Northern Territory Crown Land.



Figure 1. Location of Rum Jungle mine site

This EMP relates to four sites – the main Rum Jungle mine site, two satellite sites and a borrow area– that form the overall Rum Jungle rehabilitation project: Rum Jungle mine site, Mount Burton, Mount Fitch and the Finnis River Land Trust (FRLT) Borrow Area.



Figure 2. Map of Rum Jungle satellite sites and FRLT Borrow Area, relative to the main Rum Jungle Mine Site

1.2 Rum Jungle mine site

There are 14 features of the main site, resulting from mining undertaken between 1954 and 1971, and subsequent rehabilitation efforts in the 1970s and 1980s and are identified in Figure 3 and listed below.

1. Main Pit
2. Intermediate Pit
3. Dysons Backfilled Pit
4. Main Waste Rock Dump (WRD)
5. Main North WRD
6. Intermediate WRD
7. Dysons WRD
8. Old Tailings Dam Area
9. Copper Extraction Pad Area
10. Old Stockpile Area
11. Borrow Area 5
12. East Branch Finniss River
13. Diversion channel
14. Acid and Sweetwater Dam Area.

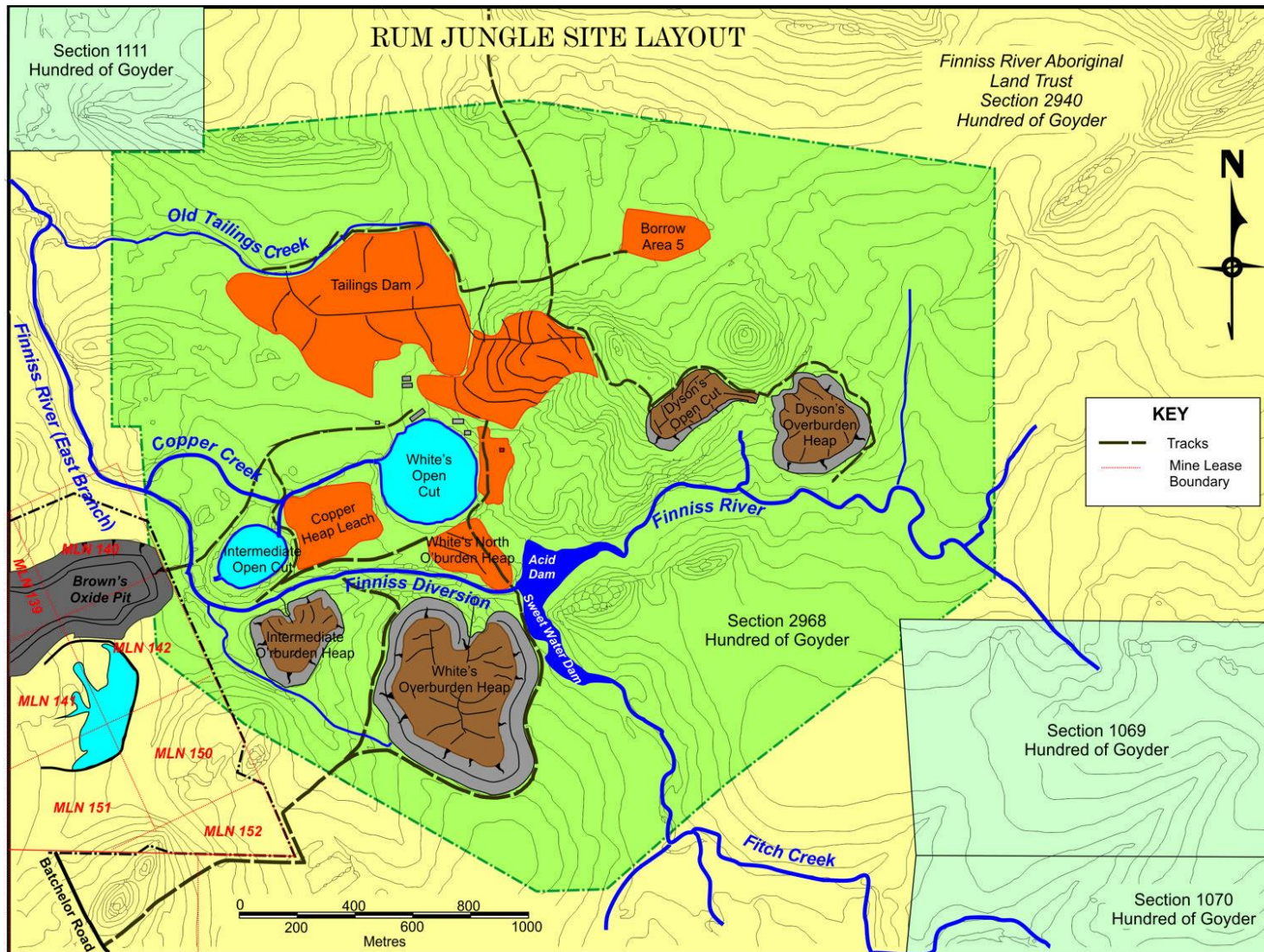


Figure 3. General layout of the Rum Jungle mine site

Surface water drainage enters Rum Jungle via the upper East Branch of the Finnis River (East Branch) and Fitch Creek. The East Branch and Fitch Creek flow directly into the Diversion Channel and into Main Pit (peak flows are directed down the Diversion Channel). Water then flows from Main Pit to the Intermediate Pit via a channel. Outflow from the Intermediate Pit then re-enters the Diversion Channel near the western boundary of the site and flow then continues eastward via the natural course of the East Branch. Groundwater flow at the Rum Jungle mine site occurs predominantly in partially weathered and/or fractured bedrock. The flow is predominantly westerly and has been significantly altered by the presence of the WRDs and the flooded pits. Groundwater contamination at Rum Jungle is localised.

1.4 Mount Burton

The Mount Burton mine site is located approximately 4 km west of Rum Jungle and is about 200 m west of the Finnis River. Mount Burton was open-cut mined for copper and uranium to a depth of 35 m. Approximately 100,000 m³ of overburden was placed in a WRD located immediately east of the open-cut pit. The pit was allowed to flood after mining ceased in 1958. The land that Mount Burton mine is situated on was converted to private freehold in 1965 and remains occupied by the same family today. There has been no post-mining rehabilitation of the site.

1.5 Mount Fitch

Mount Fitch is approximately 3.5 km northwest of Mount Burton. In 1966, a small open-cut pit was excavated for process evaluation, but no ore was recovered. The pit was allowed to fill with water following completion of activities in 1969. The land is held by the Northern Territory as a form of Crown Lease. There has been no post-mining remediation of this site.

1.6 FRLT Borrow Area

The Borrow area is located on Finnis River Land Trist land and will provide low permeability material and growth medium for use in cover construction for the new Waste Storage Facility and for some of the backfill of Main Pit. It is 8km east of the Rum Jungle Mine, adjacent to Woodcutters Mine. Material is proposed to be transported from the borrow pit area to the Rum Jungle Mine site via a purpose built haul road.

2. Preferred rehabilitation strategy

The preferred rehabilitation strategy involves the following elements as shown in Table 1.

Table 1. Preferred rehabilitation strategy for the Rum Jungle Mine Site

Domain	General activity
Main Pit	<ul style="list-style-type: none"> • Dewatering of Main Pit • Removal and treatment of residual tailings • Water treatment of pit water • Groundwater dewatering bores • Backfilling and cover system constructed
Intermediate Pit	<ul style="list-style-type: none"> • Remain as a water filled void for passive water treatment • New inflow and outflow to be designed
Dysons Backfilled Pit	<ul style="list-style-type: none"> • Contaminated overburden to be removed to tailings surface and relocated to the Main Pit • Backfilled tailings to be covered with a store and release cover system
Main WRD	<ul style="list-style-type: none"> • Waste rock to be relocated to both the new waste storage facility and the Main Pit • Footprint to be backfilled and revegetated
Main North WRD	<ul style="list-style-type: none"> • Waste rock to be relocated to new waste storage facility • Footprint to be backfilled and revegetated
Intermediate WRD	<ul style="list-style-type: none"> • Waste rock to be relocated to the Main Pit • Footprint to be backfilled and revegetated
Dysons WRD	<ul style="list-style-type: none"> • Waste rock to be relocated to new waste storage facility • Footprint to be backfilled and revegetated
Old Tailings Dam Area	<ul style="list-style-type: none"> • Residual contamination to be relocated to new waste storage facility • Footprint to be backfilled revegetated
Copper Extraction Pad Area	<ul style="list-style-type: none"> • Residual contamination to be relocated to new waste storage facility • Water pumping and treatment for heavily impacted groundwater • Footprint to be backfilled and revegetated
Old Stockpiled Area	<ul style="list-style-type: none"> • Residual contamination/waste rock to be relocated to new waste storage facility • Footprint to be backfilled and revegetated
Borrow Area 5	<ul style="list-style-type: none"> • Revegetated area to be managed and monitored • Further revegetation may be required
East Branch of the Finnis River (East Branch)	<ul style="list-style-type: none"> • Realignment to as close as possible to its original position (around the backfilled Main pit)
Diversion channel	<ul style="list-style-type: none"> • Residual contamination to be removed and channel and embankments to be altered to allow for a stable long term system • Installation of a bridge for access during and post construction
Acid and Sweetwater Dam Area	<ul style="list-style-type: none"> • Residual contamination to be removed and channel to be altered to allow for a stable long-term system
New Waste Storage Facility (WSF)	<ul style="list-style-type: none"> • Clearing of vegetation and stockpiling of soils and vegetation • Construction of new waste storage facility including appropriate drainage • Lime treatment of waste rock • Seepage collection and treatment system • Revegetation of new landform • Construction and decommissioning of haul roads

Domain	General activity
Water Treatment Plant	<ul style="list-style-type: none"> • Construction of water treatment plant and associated infrastructure • Water treatment including the management treatment wastes • Decommissioning of Water Treatment Plant
Haul Roads	<ul style="list-style-type: none"> • Clearing of vegetation and stockpiling of soils and vegetation • Construction of haul roads and suitable drainage • Decommissioning of haul roads and rehabilitation of areas
Borrow Areas	<ul style="list-style-type: none"> • Clearing of vegetation and stockpiling of soils and vegetation • Removal of borrow materials • Contouring borrow areas and revegetation
Proposed Site Facilities	<ul style="list-style-type: none"> • Construction of proposed site facilities • Installation of services for facilities • Storage of materials and fuels • Decommissioning of facilities and services and rehabilitation of areas
Mount Burton	<ul style="list-style-type: none"> • Removal of waste rock and general waste from site to new waste storage facility at Rum Jungle • Contouring and revegetation of WRD footprint
Mount Fitch	<ul style="list-style-type: none"> • Backfilling of pit with WRD • Contouring and revegetation of WRD footprint

3. Key management plans

Key management plans will be summarised in the main Rum Jungle EMP, and each individual management plan will contain details of the implementation strategy for each major element that expresses significant risk as part of the overall environmental management framework.

Table 2. Key management plans and the impacts addressed.

Management plan	Management plan elements
Biodiversity	Threatened species Feral animals / pests Weeds Land clearing
Radiation	Exposure pathways Hazardous materials Air/water/waste/background levels OH&S Radioactive waste
Hazardous Substances and Dangerous Goods	Chemicals, spills, handling & storage, fuel OH&S Asbestos
Environmental Occupational Health & Safety	Spill response Chemical handling Waste generation
Water	Surface water Groundwater Water treatment - Dewatering facility for wastewater Erosion and sediment control Stormwater Acid and metalliferous drainage Final voids
Air Quality	Dust /odour/ambient/background/asbestos
Noise & Vibration	Noise and vibration
Cultural Heritage	Indigenous and European heritage

The management plans all utilise a structure as set out below:

- Potential impacts – the activities and aspects identified for proposed activities
- Objective – the general policy relating to the management measures
- Methodology – specific environmental management measures to be undertaken to mitigate environmental risks associated with the particular project element at certain stages in the project, which include:
 - Pre-construction –relating to a baseline, including set up and site preparation
 - Construction-phase – relating to the main operational and decommissioning phase of the project
 - Post-construction –relating to project activities after works are completed
- Monitoring – specified monitoring programs for assessing the performance of each proposed environmental management measure
- Responsibility – the position, individual or entity responsible for managing and accessing each proposed environmental management measure and activity
- Reporting – the way in which each proposed environmental management measure or proposed activity will be conveyed, frequency of issue and proposed recipient
- Corrective action – the proposed strategy when the performance of environmental management measures has not been achieved.

The Environmental Management Framework in which the EMP is outlined in Figure 4.

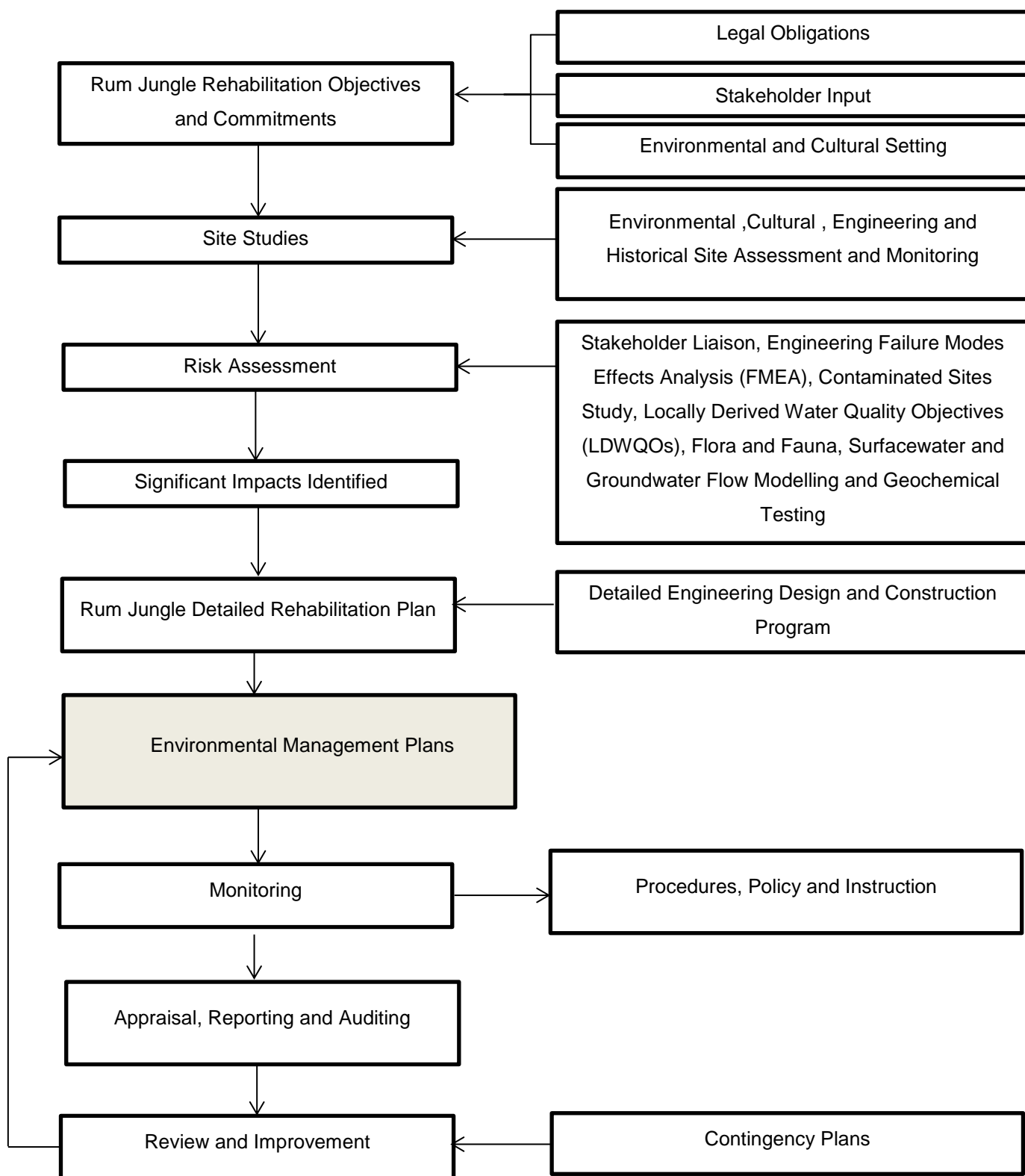


Figure 4. Key management plans location within in Environmental Management Plan

4. Legislation and guidelines

An overview of Commonwealth and Territory legislative requirements and guidelines are outlined in this section. In addition, all specific standards, policies and guidelines relevant to the environmental aspects of the project are listed in the relevant section under 'Management measures'.

A Compliance Register detailing all legal information and regulatory guidance relevant to the project will also be developed. The Compliance Register will capture statutory obligations, necessary approvals, compliance, conformance, consultations and agreements. The compliance register will be updated every six months and will be available to all stakeholders.

4.1 Statutory requirements

Commonwealth and international legislation

- *Environmental Protection Act 1978*
- *OHS&W Act 1986*
- *Environment Protection and Biodiversity Conservation Act 1999*
- *National Environment Protection Measures (Implementation) Act 1998*
- *Aboriginal and Torres Strait Islander Heritage Protection Act 1984*
- *Australian Radiation Protection and Nuclear Safety Act 1998*
- *Atomic Energy Act 1953*
- Code of Practice – Management and Control of Asbestos in the Workplace
- Code of Practice – Safe removal of Asbestos.

Northern Territory Legislation

- *Mining Management Act 2015*
- *Environmental Assessment Act 2013*
- *Waste Management and Pollution Control Act 2015*
- *Environmental and Offences and Penalties Act 2011*
- *Public and Environmental Health Act 2016*
- *Soil Conservation and Land Utilisation Act 2004*
- *Weeds Management Act 2001*
- *Water Act 2013*
- *Radiation Protection Act 2012*
- *Radiation Protection Regulations 2012*
- *Radioactive Ores and Concentrates (Packaging and transport) Act 2011*
- *Native Title Act 1993*
- *Aboriginal Sacred Sites Act 1989*

- *Heritage Act 2011*
- Work Health and Safety (National Uniform Legislation) Regulations 2015
- WorkSafe Codes of Practice approved under NT WorkSafe
- Asbestos Management Policy
- Dangerous Goods Act and Regulations.

Guidelines and standards

- Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing 2005
- Recommendations for Limiting Exposure to Ionizing Radiation (1995) and National Standard for Limiting Occupational Exposure to Ionizing Radiation
- Guidance docs from the International Atomic Energy Agency (IAEA) on closure of uranium mines and mills

5. Roles and responsibilities

Site Management Structure

The following organisation chart (Figure 5) shows the anticipated management structure for the rehabilitation program. Positions and responsibilities for the Principal Contractor and any Subcontractors are not known at this stage. Once construction tenders have been awarded, this plan will be revised in order to reflect the contractors' management structure and position responsibilities.

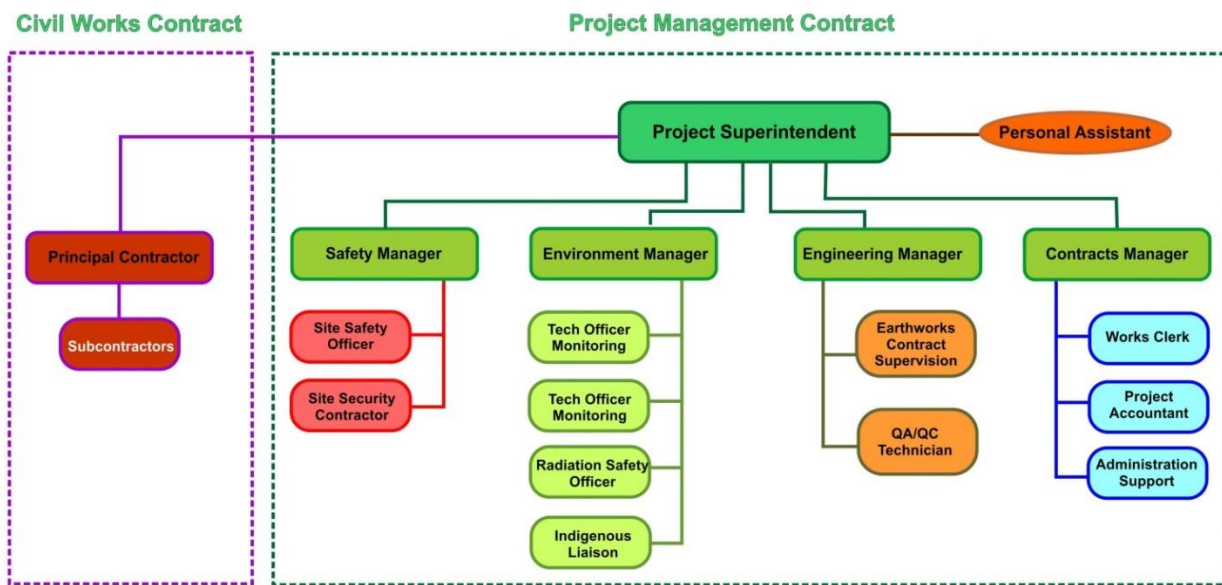


Figure 5. Organisational chart for the management of the rehabilitation project.

The DME will ultimately be the responsible authority for the project including its environmental performance. Roles and responsibilities of key staff in relation to the EMP are detailed below in Table 3. Note, these may be amended upon commencement of project.

Table 3 Roles and responsibilities, in relation to the EMP, of key personnel involved in the Rum Jungle project.

Role	Responsibility
DME and Contractor Principals	Ensure adequate resourcing is provided to ensure environmental compliance and implementation of the EMP.
Environment Manager	Implement the EMP, including review and recommendations for improvement. Communicate and implement the EMP commitments. Maintain a compliance register and communicating any

Role	Responsibility
	<p>changes.</p> <p>Monitor and report on environmental compliance.</p> <p>Report environmental incidents with the potential to impact on the environment.</p> <p>Coordinate environmental investigations.</p> <p>Ensure that all site personnel and visitors are inducted to the site are made aware of their environmental responsibilities and commitment to adhering to the EMP.</p> <p>Update and review the environmental risk register.</p>
Construction and operation managers	<p>Understand the content of the EMP and its associated management measures within each key plan</p> <p>Ensure that the content of the EMP is communicated to staff and subcontractors and that information is understood and adhered to.</p> <p>Train all personnel and contractors in relation to the EMP and its management measures.</p> <p>Ensure that all work is carried out in accordance with the EMP.</p> <p>Undertake regular site inspections to ensure conformance to EMP requirements.</p> <p>Report any environmental incidents to the Environmental Manager within 24 hours.</p> <p>Maintain a training register for all staff, contractors and visitors.</p>
Site supervisors	<p>Undertake all assigned work according to the EMP.</p> <p>Report environmental incidents to the Environmental Manager within 24 hours.</p> <p>Understand the contents of the EMP and how it impacts specific work areas and activities.</p>
All employees and subcontractors	<p>Comply with all site procedures.</p> <p>Report on incidents of likely environmental harm to specific work areas and activities.</p> <p>Understand that all personnel have a responsibility to report incidents under the General Duty of Care of the <i>Environmental Protection Act (1994)</i> and are bound by the commitments outlined within the EMP.</p>
Visitors	<p>Understand that all personnel have a responsibility to report incidents under the General Duty of Care of the <i>Environmental Protection Act (1994)</i> and are bound by the commitments outlined within the EMP.</p>

6. Environmental performance measures

This EMP has been developed in accordance with Territory and Commonwealth legislation and guidelines, as outlined in section 4, and has also adopted environmental best practice for all aspects of the project. The environmental management measures outlined in the key management plans incorporate performance measures, to ascertain if activities meet the required standards.

Performance measures evaluate any changes in environmental conditions resulting from the activities undertaken. Using performance measures allows for a systematic approach to determining the success of environmental management elements or activities. Performance goals must be targeted and quantifiable, they act as a metric for assessing changes in the condition of the environment, pressures that are affecting it and any change in the associated risks.

As part of the environmental management, monitoring, review and reporting system, indicators also need to be periodically reviewed and refined. The environmental measures will be specified in the individual key management plans. Where necessary, performance indicators of associated management measures will outline specific standards, how to handle non-conformities and corrective actions under the review process.

6.1 Corrective actions

The EMP will identify corrective actions (Figure 6) when the performance of an environmental management measure has not been achieved. The following process will be engaged to determine a corrective action:

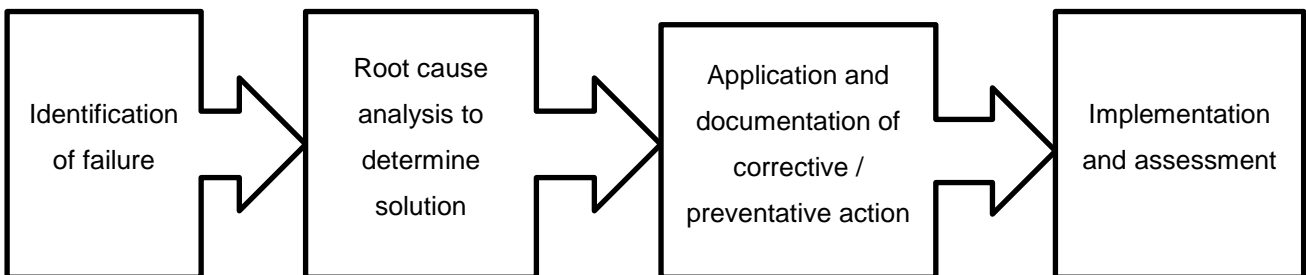


Figure 6. Corrective action process

The performance of an environmental management measure is assessed through audits, performance reviews, incident reports, investigations, non-compliance reports and ongoing monitoring programs. The environmental performance indicators will be determined by the objectives of the environmental management strategy or monitoring program, which will identify what parameter is to be measured, why, and how frequently. Regular reviews of the processes, monitoring results and data trends will determine if

performance requirements and environmental performance indicators are being sustained, or if any deviation from the proposed management strategy should occur.

The frequency of regular reviews and inspections will be considered. These reviews may be dependent on the level of risk and changes imposed on a proposed environmental measure or environmental considerations such as seasonal variation or habitat cycles.

Failure to achieve environmental target values or declining environmental trends will trigger a predetermined review process to define what corrective action is required. These corrective actions and circumstances will trigger an audit and review process, which will be detailed in each key management plan. The responsibility for review and implementation of corrective actions will also be identified in each key management plan.

7. Environmental training

All contractors and visitors entering site must undergo adequate and suitable training covering relevant environmental risks and responsibilities. A suitable induction must be completed that addresses environmental obligations and awareness as outlined in the EMP. Environmental topics to be covered in the induction will include, but are not limited to:

- occupational health and safety
- cultural heritage awareness
- radiation management
- hazard and incident reporting
- water management
- waste management
- chemical and hydrocarbon management
- land management.

All training records will be kept in a Training Register by the site management. Refresher training will be conducted annually, and on an as needs basis, and a role-specific training matrix will be produced and maintained by site management.

8. Reporting

Internal reporting will include monthly project reports highlighting performance against agreed objectives, targets and key indicators. Reports will also report on any incidents during that period.

External reporting will include statutory reporting requirements required by relevant approvals.

9. Potential environmental impacts and risks

The risk management strategy for the construction project works covers the potential environmental risks associated with the proposed works. The potential environmental risks have been determined using environmental best practice including *ISO 31000:2009 – Principles and Guidelines on Implementation*.

The EMP's risk management strategy will include a risk register for each activity or source–pathway–receptor linkage identified as being of significant environmental risk. The register will be continually updated and reviewed biannually by site management. The performance indicators will be used to determine the success of environmental risk management strategies and will be amended, where necessary.

9.1 Failure Modes Effects Analysis

All potential construction works at the site have been risk assessed using a Failure Modes Effects Analysis (FMEA). The FMEA is a top-down, systematic approach to risk appraisal and identification of mitigation measures. The aim is to use expert knowledge to evaluate the potential for failures in the rehabilitation strategy that could impact the environment, legislation, reputation, human health and safety of the site and those on the site. Redundancy or mitigation measures for the identified risks can be built into the strategy as shown in Table 4 and Table 5.

9.2 Risk definitions

The term 'risk' encompasses the concepts of the likelihood of failure, the 'expected' frequency of failures, and the severity of the expected consequences if such events occur. The criteria set for the likelihood of a risk occurring is outlined in Table 4, while Table 5 identifies the conditions for the assessment of 'severity of consequence' that specific to Rum Jungle.

The risk register, based on the FMEA is located in Appendix 1.

Table 4 Likelihood of risk used in the Failure Mode Effects Analysis

Likelihood class	Likelihood of occurrence
Not Likely (NL)	< 0.1% chance of occurrence
Low (L)	0.1 – 1% chance of occurrence
Moderate (M)	1 – 10% chance of occurrence
High (H)	10 – 50% chance of occurrence
Expected (E)	> 50% chance of occurrence

Table 5 Failure Mode Effects Analysis: Severity of effects agreed and used in the FMEA process

Consequence Categories	Low	Minor	Moderate	Major	Critical
Environmental impact	No observable effect	Minor localised or short-term effects	Deleterious effect on valued ecosystem component	Extensive deleterious effect on valued ecosystem component with medium-term impairment of ecosystem function	Serious long-term impairment of ecosystem function
Costs of the consequence	< \$100,000	\$100,000 – \$500,000	\$500,000 – \$2 million	\$2 million – \$10 million	> \$10 million
Human health and safety	Low-level short-term subjective symptoms No measurable physical effect No medical treatment required	Objective but reversible disability/impairment and/or medical treatment Injuries requiring hospitalisation	Moderate irreversible disability or impairment to one or more people	Single fatality and/or severe irreversible disability or impairment to one or more people.	Multiple fatalities

10. Audit and review

This EMP will be subject to an Environmental Audit Program and is to be included in any subsequent audit schedule. All contractors associated with the project will be required to review and audit their performance against this EMP through internal checks and third-party audits. A formal reporting process will be established that will require contractors to report on their auditing activities and outcomes.

The Environmental Audit Program will include:

- internal environmental audits
- legal compliance audit and monitoring results review
- external audits by third party ISO certified auditor
- government audits (e.g. Commonwealth, NT EPA).

A review of this EMP will be conducted biannually by site management and findings communicated to all stakeholders of the project.

11. References

1. Department of Mines and Energy, 2013. Former Rum Jungle Mine Site: [Conceptual Rehabilitation Plan](#). Report prepared for Commonwealth Government Department of Industry. Publicly available.

Appendix 1

Table A-1: Failure Mode Effect Analysis: Backfilling Main Pit

Failure mode ID	Failure mode description	Effects and pathways	Likelihood		Consequences						Level of confidence	Highest risk rating	Mitigation/comments	
					Environmental impact	Consequence costs	Human health	Safety						
1	Groundwater inflow	leading to flooding of base of pit floor ahead of construction	L	L	L	L	L	L	L	L	H	L	Placement of monitoring bore, knowledge of groundwater flows to that point will mitigate this failure. If required, continued water treatment and discharge system will have to be put in place.	
2	Liming system along conveyor belt not sufficient	leading to inadequate lime application during material placement	L	L	L	L	L	L	L	L	H	L	During the discussion the question of quantifying the cost of delays, for one week or one month for example, were raised. While not possible at this stage, these consequence costs may be revisited, once a scheduling and project plan has been more fully defined.	
3	In pit mixing during trucking process is not adequate	leading to inadequate lime application during material placement	H	L	Mo	Mi	Mo	L	Mo	L	Mo	H	Mo	Addition of extra 1% lime (the most expensive product is \$150/t, unlikely that this is required, so this would be the upper limit of additional costs).
4	Over addition of lime	leading to cost higher than necessary to achieve the environmental benefit	NL	L	L	L	L	L	L	L	H	L	No perceived negative environmental impact; most times to little lime is added.	
5	Failure to create a working platform as a result of submerged objects	leading to additional need for conveyance of waste rock, as opposed to using haul trucks	M	L	L	Mi	Mo	L	L	L	M	Mo	Will be reviewed as part of scheduling and design. Sufficient thickness of end tipped/conveyed material required and will most likely cover submerged objects.	
6	Geotechnical failure of the pit wall during backfilling	leading to interruption of construction	E	L	Mo	Mi	Mo-H	L	Mo	L	Mo	M	Mo-H	Safety plan for work in pit around any areas identified as susceptible to failure.
7	Instability and/or bearing capacity failure of backfilled floor during backfilling	leading to inability to place waste and inability to access pit floor	H	L	Mo	L	Mo	L	Mo	L	Mo	H	Mo	Sufficient thickness of end tipped/conveyed material required and will most likely provide stability.
8	Inability to complete the fill in one dry season	leading to extension of construction schedule	H	L	Mo	Mi	Mo	L	Mo	L	Mo	H	Mo	Increased diversion will be in place. Only incidental rainfall will report to inner pit, with the implication for additional water treatment. Likelihood increased to high following July 2015 workshop, owing to changes to overall construction schedule, does not represent a high risk above baseline as budgeting not conducted at this stage.

Table A-2: Failure Mode Effect Analysis Cu Extraction Area Clean Up

Failure mode ID	Failure mode description	Effects and pathways	Likelihood	Consequences								Level of confidence	Highest risk rating	Mitigation/comments
				Environmental impact	Consequence costs	Human health	Safety							
1	Hydrogeologic regime not behaving as predicted/modelled during groundwater treatment	leading to migration of copper plume to dolostone to the west northwest	L	Mo	Mo	Mi	L	L	L	L	L	M	Mo	Environmental effect would be a sulfate effect. Potential over time the Cu may develop, low likelihood.
2	Insufficient removal of contaminated materials in waters due to incorrect definition of contaminated aquifer	Continued release of contaminant to intermediate pit and East Finnis River	H	L	Mo	Mi	Mo	L	Mo	L	Mo	H	Mo	Expect the environmental impact to be contained, as currently. Even residual contaminant levels will have low environmental impact. The contribution to cumulative impacts may be more significant, and push thresholds if not treated.
3	Upset of inline treatment system	Leading to contaminated water going into the main pit	L	L	L	L	L	L	L	L	L	H	L	If technological issues occur the system will be shut down and reset.
4	Residual copper contamination after pumping	Leading to contamination of water in the diversion channel	NL	Ma	Mo	Mi	L	L	L	L	L	L	Mo	The temporal release (May-June) is of more concern than the load. Little other dilution of flow, and critical time for local biology. Pulses of high level of contaminant have less influence. Recessional flows and more important than first flush.
5	Residual solid contaminant source that cannot be removed by pumping	Leading to unexpected contamination to diversion channel/East Finnis River	NL	L	L	L	L	L	L	L	L	H	L	Secondary mineralisation unlikely due to pH of waters (3).
6	Residual copper contamination after pumping	Leading to the need to revisit the pumping and treatment of the contaminated water	NL	L	L	L	L	L	L	L	L	H	L	Addressed in previous Failure modes/Pathways
7	Residual secondary minerals not removed by pumping	Leading to continued elevated metal concentrations in groundwater	NL	L	L	L	L	L	L	L	L	H	L	Addressed in previous Failure modes/Pathways
8	Residual copper contamination after pumping	Leading to contamination of water in a diversion channel that is deeper	L	Ma	Mo-H	L	L	L	L	L	L	L	Mo-H	This relates more to elevations. Needs review of detailed water levels in this area. Possibly could be ranked as NL. Low confidence in ranking.

Table A-2: Failure Mode Effect Analysis Cu Extraction Area Clean Up (cont.)

Failure mode ID	Failure mode description	Effects and pathways	Likelihood	Consequences								Level of Confidence	Highest Risk Rating	Mitigation / Comments
				Environmental Impact	Consequence Costs	Human Health	Safety							
9	Errors in classification of material	Leading to remaining contaminated soil in the area	L	Mi	L	Mi	L	L	L	L	L	M	L	Captured in Failure modes and effects 2 and 3, below.
10	Lack of understanding of the chemical cut off contamination levels	Leading to remaining contaminated soil in the area	L	Mi	L	Mi	L	L	L	L	L	M	L	Project that is in progress, results pending. If current work identifies further work to be completed, this will be done. Metals concentration in the mine area should be monitored, to date limited data has been collected, mostly from upstream or downstream of the mine area.
11	Lack of understanding of the depth of contaminated material	Leading to remaining contaminated soil in the area	L	Mi	L	Mi	L	L	L	L	L	M	L	Project work in progress to define this.
12	Additional volume of material required for removal	Leading to more effort to remove material and more borrow material required.	M	Mi	Mo	Mi	Mo	L	L	L	L	M	Mo	Cumulative increase in requirement for borrow materials should be considered. Harder digging with increased depth which will require an upscale of equipment and potential increase in costs.
13a	Incision of water eroding replacement material into contaminated residual material	leading to contaminated water entering the intermediate pit	L	Mi	L	L	L	L	L	L	L	H	L	We can control the amount of gully and scouring by controlling the water level and engineering the surfaces.
13b		leading to back scouring, gully into the covered main pit	L	Mi	L	Mi	L	L	L	L	L	M	L	Not a single event, a cumulative effect that will have maintenance and monitoring. Assuming that the initial period includes the diversion to allow for establishment of this area. Through the design reduce the flow velocities to minimise potential for scouring
14a	Failure to design the flood channel properly	leading to an over excavation of the area	NL	Mi	L	Mi	L	L	L	L	L	H	L	Detailed design will be undertaken based on design storm.
14b		leading to an under excavation of the area	NL	Mi	L	L	L	L	L	L	L	H	L	Widening of the channel, covered in previous effects/pathways due to characterisation
14c		leading to sediment deposition into the intermediate pit and reducing capacity for water treatment	L	L	L	Mi	L	L	L	L	L	M	L	Volume of cu extraction replacement material is not equal to the volume of the pit. Define the proportion of volume required in the pit. Effect/pathway is not necessarily a reflection on failure of design. This assumes that an alternative water treatment would be put in place, in a timely manner.
15	Flow conditions exceeding the designed flow (1:200)	Leading to overwhelming of channel design and sediment erosion and loss of water treatment capacity	NL	Mi	L	Mi	L	L	L	L	L	M	L	Incremental design cost for a 1:1000 design to be assessed, relative to 1:200 design
16	Failure to remove and place the replacement material before the wet season	leading to large scale erosion of unconsolidated materials, filling the pit quickly and altering of channel pathways	NL	Mi	L	Mi	L	L	L	L	L	M	L	Requirement for sediment control and revegetation plan, addressed in initial establishment design with diversion
17	Contaminated groundwater encountered during excavation of materials	leading to water treatment requirements during excavation	L	L	L	L	L	L	L	L	L	H	L	Overall water treatment facility design should be able to cope with potential additional flow.
18	Groundwater levels are higher than expected	leading to groundwater expressing itself into the channel, continued discharge of contaminated water into the channel	L	L	L	L	L	L	L	L	L	H	L	Groundwater and pit water elevations should be considered in the design. No shallow groundwater monitoring in this area.

19	Slumping of intermediate pit walls, due to geotechnical failure	leading to loss of volume in intermediate pit for treatment works, and destabilisation of any other works	NL	L	L	L	L	L	L	L	L	M	L	Not considering mass failure, only small scale pit instability, although this does depend on the location of any slumping. Review any geotechnical reports on this issue, initiate studies if information unavailable.
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Table A-3: Failure Mode Effect Analysis Cumulative and Interactive Elements

Failure mode ID	Failure mode description	Effects and pathways	Likelihood	Consequences								Level of confidence	Highest risk rating	Mitigation/comments
				Environmental impact	Consequence costs	Human health	Safety							
1	failure to develop site wide water balance which accurately reflects the clean and dirty elements during construction	leading to more dirty water than capacity to store and treat and capacity to discharge and manage, offsite discharge of contaminated water	M	Mi	Mo	Mo	Mo-H	L	L	L	L	H	Mo-H	Water balance must include seepage. Ranked as Minor environmental impact, although the failure could occur over more than one wet season and compound/increase the impact.
2	failure to develop site wide water balance which accurately reflects the clean and dirty elements post- construction	leading to more dirty water than capacity to store and treat and capacity to discharge and manage, offsite discharge of contaminated water	L	Mi	L	L	L	L	L	L	L	H	L	Construction stage failure modes identified this item. It is anticipated that during construction stage lessons learnt and mitigation methods will be applicable to the site wide continued works. Good communication with different teams will be required to ensure all lessons/ mitigation methods are discussed with any flow through impacts highlighted.
3	Failure to develop a proper material balance for waste and borrow materials	leading to delays and or failure to construct properly, being unprepared for wet season, and related cost blow outs	M	L	L	Mo	Mo-H	L	L	L	L	H	Mo-H	Identifying off site sources of materials, filing and receiving the relevant approvals and transporting material will increase project costs and potentially lead to delays.
4	Undefined cumulative footprint for rehabilitation	leading to unanticipated need for further rehabilitation onsite	M	Mi	Mo	Mi	Mo	L	L	L	L	M	Mo	The cumulative footprint includes haul roads, material storage areas, ramps. The group identified a moderate likelihood of the re-routing of these, increasing the footprint.
5	Undefined cumulative footprint for rehabilitation	leading to unanticipated need for rehabilitation offsite	M	Mo	Mo-H	Mi	Mo	L	L	L	L	M	Mo-H	Assuming clearing is significant and in areas of little to no previous disturbance. Focus on restoration of biodiversity and stability during the first 5 yrs of vegetation establishment.
6	Failure to design an effective integrated sediment control system during construction	leading to loss of valuable construction resources, damage to infrastructure	L	Mi	L	Mi	L	L	L	L	L	M	L	Infrastructure cost has vulnerability, but should be designed with this in mind. Scheduling and storage/placement of materials is assumed to be managed in an appropriate manner
7	Failure to have integrated planning and system wide integration of sequencing, construction and controls	leading to delays in construction, failure to follow planned designs for construction, cost increases	L	L	L	Mo	Mo	L	L	L	L	H	Mo	A construction scheduling professional should be consulted and involved in the design processes to understand the overarching aims of the project, and ensure that scheduling targets are realistic and achievable.
8	failure to anticipate cumulative effects within the integrated system during construction	leading to exceedance of water quality limits, or design capacity	L	Mi	L	Mi	L	L	L	L	L	L	L	Low rankings are for a one-off event, although these may be reoccurring and require the need to revisit annually.
9	Failure to identify the critical pathways in the schedule for construction and implementation	leading to significant failure in construction schedule, planning for wet/dry season activities	L	L	L	Mo	Mo	L	L	L	L	L	Mo	Construction scheduling has to be engaged. Construction experts/professionals to be consulted and review.

Failure mode ID	Failure mode description	Effects and pathways	Likelihood	Consequences								Level of confidence	Highest risk rating	Mitigation/comments
				Environmental impact	Consequence costs	Human health	Safety							
10	Severe fire event across the site	leading to destruction of revegetation, increased erosion, destruction of equipment, delays in construction	L	Mi	L	Mo	Mo	L	L	L	L	M	Mo	Control burning and fire management plan to be put in place.
11	Site wide flood	leading to widespread erosion, overwhelming of water treatment facilities, disruption of construction, lack of site wide access	M	Mi	Mo	Mi	Mo	L	L	L	L	M	Mo	Predicting cyclone/severe weather event warning system most probably required. This is particularly important during the early/late season.
12	Spread of unwanted plants during construction and rehab establishment	leading to development of monoculture, destabilisation of landforms, cultural objectives not being met	M	Mo	Mo-H	Mi	Mo	L	L	L	L	M	Mo-H	Weed management plan and wash down areas, access and contractor controls
13	Inadequate control of feral animals	leading to unpredicted impacts on rehabilitated areas during construction and rehab establishment	M	Mi	Mo	Mi	Mo	L	L	L	L	M	Mo	Feral animal management plan to be compiled and implemented at least until ecosystem well established.
14	Unearthing of unidentified radiological source/issue	leading to disruption of schedule, contamination of equipment.	L	L	L	Mi	L	L	L	L	L	H	L	Continuously monitor materials but unlikely.
15	Failure to plan for site wide organism access and habitat opportunities	leading to failure to establish desired ecosystem regime	L	Ma	Mo-H	Mo	Mo	L	L	L	L	H	Mo-H	Ensure ecological input in all phases of design and construction planning and scheduling. Inclusive of terrestrial and aquatic ecosystems. Perception of success and failure has an impact on this failure mode
16	Failure to return all areas of disturbance to sufficient biodiversity	leading to degraded ecosystems, negative perception	L	Ma	Mo-H	Mo	Mo	L	L	L	L	H	Mo-H	captured as above.
17	Inappropriate land use	leading to failure to meet remediation requirements	L	Mi	L	Mo	Mo	L	L	Mo	Mo	H	Mo	Requires appropriate access controls, and the communication of clear expectations of end land use to the community.
18	failure to protect Indigenous cultural heritage places/features	leading to delays in schedule	L	L	L	Mi	L	L	L	L	L	H	L	Compliance with AAPA Authority Certificate will be integrated in every contract for work. Failure to comply will result in fines, removal from site, potential prosecution and construction delays. Reputational impacts, socio-political perceptions. Approval documents, inductions and training will be included for all work teams. Communication through the liaison committee.
19	Failure to gain timely approval from relevant authorities	leading to scheduling delays	L	L	L	Mo	Mo	L	L	L	L	M	Mo	Early engagement. Uncertainty about EIS requirement. This requirement would significantly impact the risk rating.
20	Interactions from neighbouring sites	leading to unanticipated delays in construction and design, changing requirements	NL	L	L	Mo	L	L	L	L	L	H	L	Potentially Browns oxide. There could be water interactions in the intermediate pit / groundwater.

Table A-4: Failure Mode Effect Analysis Dewatering Pits

Failure mode ID	Failure mode description	Effects and pathways	Likelihood		Consequences							Level of confidence	Highest risk rating	Mitigation/comments
					Environmental impact	Consequence costs	Human health	Safety						
1	Failure to dewater the main pit during the designed dewatering phase	leading to delay in construction by at least 1 yr	L	L	L	Mo	Mo	L	L	L	L	H	Mo	Assuming all discharge requirements are met. Points towards need to start dewatering in the dry and include water treatment
2	Failure to keep the area dry for the ~ 2 yr period	leading to flooding of main pit and associated construction areas	L	Mi	L	L	L	L	L	L	L	H	L	Levee for temporary and/or final design of diversion prior dewatering during wet season, likelihood assessed on design for 1:200 yr event. Minor environmental impact given we have intermediate pit as a buffer. Mitigate by dewatering in dry season, with first foundation on tailings before wet season starts.
3	Ingress of water at the end of dewatering through the failure of diversion system	leading to mobilisation of tailings and contaminated pore water into pit waters and downstream	L	L	L	Mi	L	L	L	L	L	M	L	Unlikely if dewatering is scheduled correctly.
4	Unable to meet the waste discharge license conditions	leading to delay in schedules	L	L	L	Mi	L	L	L	L	L	M	L	Need more information on downstream concentrations of metals from the pit. Assumes all requirements and testing are met and completed.
5a	Failure to properly predict pit wall instability due to rapid dewatering	leading to unanticipated pit wall failure, slump, collapse	E	L	Mo	Mo	H	L	Mo	Mo	H	M	H	Design criteria to include safety controls to limit work at potential geotechnical failure zones, i.e. a remote operation.
5b		leading to turbulence mobilisation of highly contaminated sediments, further treatment requirements.	E	L	Mo	Mi	Mo-H	L	Mo	L	Mo	M	Mo-H	Additional treatment costs potentially. Dependent on location and time of failure.

Table A-5: Failure Mode Effect Analysis Waste Storage Facility Foundation Waste Placement and Cover

Failure mode ID	Failure mode description	Effects and pathways	Likelihood		Consequences							Level of confidence	Highest risk rating	Mitigation / Comments
					Environmental impact	Consequence costs	Human health	Safety						
1a	Base/Liner of WRF more permeable than designed	Failure to construct (technique, equipment etc.) as per detailed design, not attain design specifications (density, permeability etc.)	M	Mi	Mo	L	L	L	L	L	L	H	Mo	Larger group ranked likelihood as low. If not constructed properly at collection low point some participants thought likelihood Moderate; Could be mitigated. Materials will be placed above and below the liner. Construction and ranking does not include any budget constraints on the specification for the liner.
1b		Failure to construct as per detailed design, materials can't meet design specifications	M	Mi	Mo	L	L	L	L	L	L	H	Mo	Materials different or changes over time potentially forming secondary minerals - could get blocked and doesn't drain. Could lead to failure of lateral drainage system.
2	Failure of Lateral Drainage	Leading to geotechnical failure	M	Mo	Mo-H	Mo	Mo-H	Mi	Mo	L	L	M	Mo-H	Increased porewater pressure could cause failure.
3	Flooding to foundations due to in excess of design during WSF construction (groundwater rise as well as flooding from catchment)	Sediment loss to surface water resources	H	Mi	Mo	L	Mo	L	Mo	L	Mo	H	Mo	Rise in groundwater level could lead to increased runoff that may increase erosion of the WSF toe. Can be mitigated with engineering design.
4	Flooding to foundations due to rainfall event in excess of design during WSF construction due to direct rainfall	Sediment loss to surface water resources	H	Mi	Mo	L	Mo	L	Mo	L	Mo	H	Mo	Impact mainly the cost of lost material key, some participants had lack in confidence that mitigation/protection measures would be sufficient.
5	Loss of resource due to flooding and rainfall	Loss of volume of material	H	Mi	Mo	Mi	Mo	L	Mo	L	Mo	M	Mo	Rise in groundwater level could lead to increased runoff that may increase erosion of the WSF toe. Can be mitigated with engineering design.
6	Flooding to foundations due to rainfall event in excess of design for final landform	Contamination to surface and groundwater resources	L	Mi	L	L	L	L	L	L	L	H	L	Critical design element based on flood status. There will be a high level of dilution during high rainfall events. Will only be a short timeframe. Engineering design will be based on appropriate design life plus safety (freeboard).
7	Foundation not performing as designed	Differential settlement in excess of design parameters	M	Mo	Mo-H	Mo	Mo-H	L	L	L	L	M	Mo-H	Differential settlement could happen after construction. Site selection, detailed engineering design of foundation and foundation preparation and QA/QC of utmost importance.
8	Failure to cover exposed waste in existing WRD prior to wet season	Wetting up of PAF waste material and release of contaminants to groundwater and surface environs.	L	Ma	Mo-H	Mo	Mo	L	L	L	L	L	Mo-H	Construction schedule important. Minimise exposed waste material at any given time. Exposed waste could be covered temporarily with large HDPE liner (reusable). The cost of a temporary liner would be a small percentage of overall cost.
9	Failure to cover exposed newly placed PAF waste prior to wet season	Wetting up of PAF waste material and release of contaminants to groundwater and surface environs.	M	Mo	Mo-H	Mo	Mo-H	L	L	L	L	H	Mo-H	Construction schedule important. Minimise exposed waste material at any given time. Exposed waste could be covered temporarily with large HDPE liner (reusable). The cost of a temporary liner would be a small percentage of overall cost.
10	Underestimation of WR materials	Less volumes of material for designed placement	M	Mi	Mo	Mo	Mo-H	L	L	L	L	M	Mo-H	Flexibility of design has to allow for over or under estimation of materials

Failure mode ID	Failure mode description	Effects and pathways	Likelihood	Consequences								Level of confidence	Highest risk rating	Mitigation / Comments
				Environmental impact	Consequence costs	Human health	Safety							
11	Overestimation of WR materials	Excess volumes of material for designed placement	M	Mi	Mo	Mi	Mo	L	L	L	L	M	Mo	Design and construction flexibility is critical. Continuous updating and confirmation of final geometrical design.
12a	Failure of characterisation and segregation of geochemical properties of materials	Leading to performance issues	L	L	L	L	L	L	L	L	L	H	L	Detailed placement and integrated waste rock facility design to account for potential changes.
12b	Failure of characterisation and segregation of geochemical properties of materials	Leading to scheduling issues	M	L	L	Mi	Mo	L	L	L	L	H	Mo	Season 1 is the focus for this scheduling. Is segregation worth all the risks to scheduling?
13	Failure of characterisation and segregation of geotechnical properties of materials	Leading to scheduling issues, insufficient volumes of materials for design as planned.	L	L	L	Mo	Mo	L	L	L	L	M	Mo	Propensity for consolidation as well
14	Failure to identify gas pockets in WRD	Leading to health and safety issues	L	L	L	L	L	L	L	C	Mo-H	H	Mo-H	Construction health and safety plan to address potential for encountering gas pockets
15	Development of gas pockets in material during transport and storage	Leading to health and safety issues	NL	L	L	L	L	L	L	Ma	Mo	H	Mo	Highly unlikely. Material not in confined space; gas should disperse when tipped. In pit disposal to be assessed.
16	Leach down of stored oxidation products takes longer than predicted	Leading to longer water treatment requirements	H	L	Mo	Mo	Mo-H	L	Mo	L	Mo	H	Mo-H	
17	Incorrect waste placement construction method leading to elevated contaminant release	Failure to incorporate lime and waste rock to prevent contamination via metal release, or inadequate volume of lime added	L	L	L	Mo	Mo	L	L	L	L	H	Mo	Differential settlement could happen after construction. Site selection, detailed engineering design of foundation and foundation preparation and QA/QC of utmost importance.
18	Incorrect scheduling of waste placement leading to increased seepage	wetting of waste material leading to additional seepage to be collected and treated	L	L	L	L	L	L	L	L	L	H	L	Unlikely to be an issue.
19	Insufficient volume available, beneath dry season water table to put PAF material	leading to additional volume required for the above ground landform	E	L	Mo	Mi	Mo-H	L	Mo	L	Mo	M	Mo-H	Assess the climate record and model groundwater levels in 100 yr drought scenario
20	Hydrogeologic regime not behaving as predicted/modelled	Failure to correctly define groundwater regime (for example greater permeability) leading to release of contaminants to groundwater	M	Mi	Mo	Mi	Mo	L	L	L	L	M	Mo	Robust groundwater model with sensitivity analysis updated.

Failure mode ID	Failure mode description	Effects and pathways	Likelihood	Consequences								Level of confidence	Highest risk rating	Mitigation / Comments
				Environmental impact	Consequence costs	Human health	Safety							
21	Failure of surface water management system due to more intense rainfall events	Higher runoff volumes leading to increased soil erosion and unacceptable sedimentation of local streams	L	Mi	L	L	L	L	L	L	L	H	L	Consider design for surface water management system for 1:200 as compared to 1:100 yr event, small incremental cost compared to large benefit. Assessment period 1000 yr; compare and adjust if deemed required.
22	Formation of erosion gullies on landform embankments due to overtopping of plateau	Unacceptable sedimentation of local streams, exposure of waste rock materials	NL	Mi	L	Mo	L	L	L	L	L	H	L	All surface runoff directed away from crest at gentle slopes; minimal erosion.
23	Formation of erosive gullies on landform embankments due to incident rainfall	Unacceptable sedimentation of local streams, exposure of waste rock materials	L	Mi	L	Mi	L	L	L	L	L	M	L	Design will consider long-term evolution modelling based on site specific materials and climatic conditions.
24a	Formation of holes/macropores in cover profile due to plant roots extending to base of cover profile.	Localised increase in net percolation rates, leading to higher seepage rates than designed	M	Mi	Mo	L	L	L	L	L	L	L	Mo	Include factor of safety in treatment facility seepage quantity design.
24b	Formation of holes/macropores in cover profile due to plant roots extending to base of cover profile.	Higher oxygen ingress rates leads to increased oxidation of sulphides, which ultimately causes detrimental effects on receiving environment.	M	Mi	Mo	L	L	L	L	L	L	L	Mo	Include factor of safety in treatment facility seepage quality design.
25a	Plant uptake of metals and/or salts due to roots extending into waste material.	Excessive bioaccumulation of metals in plant tissue leading to unacceptable health risks to wildlife and humans.	L	Mi	L	L	Mi	L	L	L	L	H	L	The probability of this failure mode is unlikely given the proposed growth medium layer thickness.
25b		Vegetation die-off leading to increased soil erosion and unacceptable sedimentation of local streams.	L	Mi	L	Mo	Mo	L	L	L	L	M	Mo	The probability of this failure mode is unlikely given the proposed growth medium layer thickness. Unknown volume of material that would need to be replaced.
26a	Poor vegetation establishment due to lack of moisture, nutrients, or physical properties of cover material.	Higher runoff volumes leading to increased soil erosion and unacceptable sedimentation of local streams.	M	Mi	Mo	Mi	Mo	L	L	L	L	M	Mo	Further characterisation and planning, with limitations on the material source.
26b		Higher net percolation rates ultimately leads to higher basal / toe seepage volumes, which causes detrimental effects on receiving environment.	L	Mi	L	L	L	L	L	L	L	M	L	Design will not only rely on the cover system. Internal dump design will contribute to reduced percolation through waste dump. Integrated design will limit this risk.
27	Failure of vegetation placement and planning	Leading to poor propagation, increased erosion and runoff than predicted	M	Mo	Mo-H	Mi	Mo	L	L	L	L	M	Mo-H	Likelihood is limited to factors outside of our control - climate, etc. See comment on cumulative effects

Failure mode ID	Failure mode description	Effects and pathways	Likelihood		Consequences							Level of confidence	Highest risk rating	Mitigation / Comments
					Environmental impact	Consequence costs	Human health	Safety						
28	Propagation of invasive/alien species due to poor biosecurity controls	Leading to development of monoculture and impedence to native species propagation	L	Mo	Mo	Mi	L	L	L	L	L	L	Mo	Controls are put into contracts to ensure wash down of vehicles entering and leaving site. Post closure monitoring and eradication.
29a	Changes in cover characteristics due to soil biology	increased oxygen ingress rates and higher net percolation rates	M	Mi	Mo	L	L	L	L	L	M	Mo	With all the other systems in place the change in net percolation rates will not be significant	
29b		Leading to higher runoff and increased erosion (lower net percolation rates)	M	Mi	Mo	Mi	Mo	L	L	L	M	Mo	Detailed design and long-term evolution modelling sensitivity analysis to consider this.	
30a	Dominance of undesirable species in new landforms, e.g. gamba grass and acacia	Leading to reduced performance of cover system	H	Mi	Mo	Mi	Mo	L	Mo	L	Mo	H	Mo	Gamba clumps together, does not provide good ground cover, following fires leaves bare ground. Data from 2014-15 wet season of acacia dominated ground to be made available. Cumulative effects of this may be classed as moderate for environmental effects
30b		Leading to higher fire intensity and replacement of biodiversity with monoculture	H	Mi	Mo	Mi	Mo	L	Mo	Mi	Mo	H	Mo	Cumulative costs if the entire site needs treatment and re-establishment of native species. Safety ranking assumes mitigation through weed management. Significant and high priority maintenance requirements for weed management, especially during first 5 yrs. Also a perception issue
30c		Leading to reduced accessibility for inspection, monitoring and stability	H	Mi	Mo	Mi	Mo	L	Mo	Mi	Mo	H	Mo	As above, weed controls should be rigorously adhered to for a minimum of the first 5 yrs, to allow for establishment of native flora.
30d		Leading to failure to meet rehabilitation objectives	H	Mi	Mo	Mi	Mo	L	Mo	Mi	Mo	H	Mo	Significant and high priority maintenance required for minimum 5 yrs. Further regular monitoring and maintenance for 15-20yrs (less intensive)
31	Flooding and flow velocities in excess of design	leading to incision of the toe of landform	L	Mi	L	Mi	L	L	L	L	H	L	Engineering solutions to be considered and designed, design will consider rock armouring of the toe up to 1:1000 flood level	

Air Quality Management Plan

20 June 2016
Version 1.2

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1.2	20 June 2016	Ali Youssef	Final. Added Site Management Structure.

Acronyms	
The following acronyms are used in this document	
Acronyms	Full form
AQ	Air Quality
AQMP	Air Quality Management Plan
DME	Department of Mines and Energy
GHG	Greenhouse Gas Emissions
NT	Northern Territory
N/A	Not Applicable
WRD	Waste Rock Dump
WSF	Waste Storage Facility

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Scope

The Air Quality Management Plan (AQMP) addresses the management, monitoring and assessment of site generated odour, dust and greenhouse gas (GHG) emissions throughout all phases of the proposed activities. It details prevention and mitigation measures associated with the construction works at Rum Jungle Mine Site (RJM), including associated borrow pit areas and haul roads; and its satellite sites of Mount Fitch (MF) and Mount Burton (MB). The AQMP also incorporates contingency measures, which are able to be implemented where impacts on air quality have been identified or neighbourhood complaints made in respect to air quality (AQ).

This document will be reviewed and updated once the construction tenders have been awarded and prior to commencement of the works.

Objective

Minimise the potential risk to the surrounding environment from site generated air emissions and not exceed the air quality impact assessment criteria. Ensure all feasible measures are taken to minimise the release of GHG emissions from site. This plan does not directly relate to human health as that will form part of specific plans to be developed and implemented by the civil works contractor.

Site Management Structure

The following organisation chart (Figure 1) shows the anticipated management structure for the rehabilitation program. Positions and responsibilities for the Principal Contractor and any Subcontractors are not known at this stage. Once construction tenders have been awarded, this plan will be revised in order to reflect the contractors' management structure and position responsibilities.

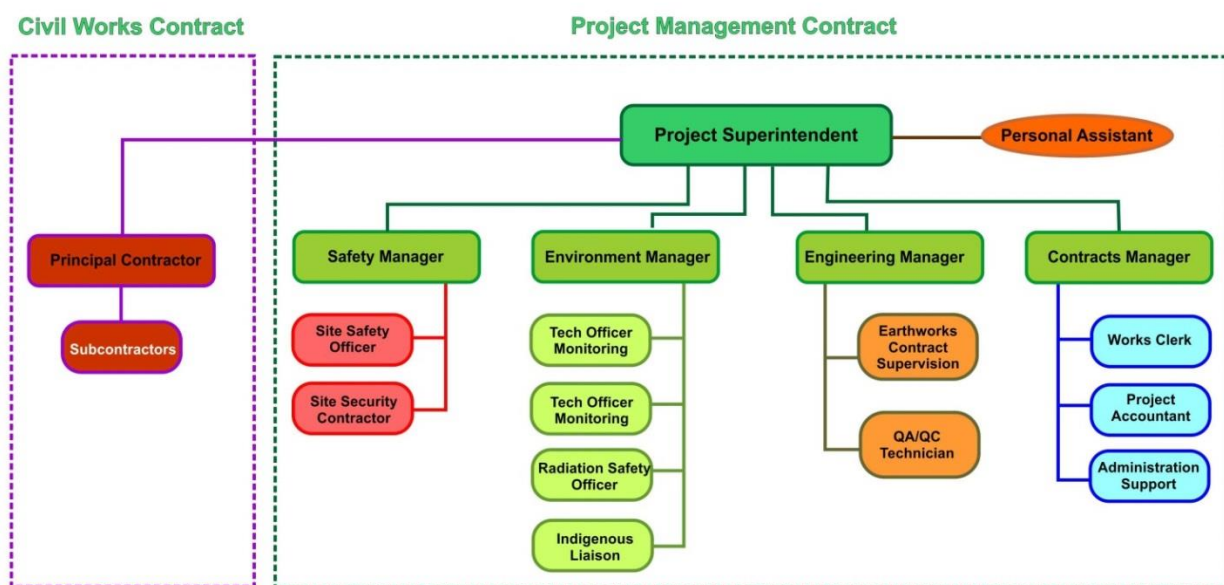


Figure 1. Organisational chart for the management of the rehabilitation project

Potential Impacts

Construction work is likely to generate air emissions which have the potential to impact nearby sensitive receptors.

Construction work may adversely impact air quality through the following activities:

Table 1. Table of construction activities and their related environmental aspects.

Activity	Aspect
Mobilisation	Dust and GHG emissions
Site preparation	
Construct all weather road access & tracks	Dust and GHG emissions
Construct bridge/causeway	Dust and GHG emissions
Construct flood levees	Dust and GHG emissions
Clear areas as required	Dust, GHG emissions, odours and gases from organic/decomposing material
Office/crib infrastructure	Dust and GHG emissions
Prepare foundations	Dust and GHG emissions
Pit backfill infrastructure prep	Dust and GHG emissions
Construct pads/hardstands	Dust and GHG emissions
Communications (satellite/mobile phones)	Dust and GHG emissions
Security, fencing, gating	Dust and GHG emissions
Install signage	Dust and GHG emission
Pumping Infrastructure	
Additional boreholes	Dust and GHG emissions
Water treatment plant (pad and plant)	Dust and GHG emissions
Power infrastructure	
Poles / wire	Dust and GHG emissions
Hookup with Power & Water	Dust and GHG emissions
Weed control	
Finniss River Land Trust Borrow Area	N/A
Other management practices (e.g. vehicle washdown)	N/A

Activity	Aspect
Dewater	
Dewater Main pit	Odours
Water treatment	
Commence pump, collect, treat	GHG emissions and odours
Ongoing weed management	N/A
Site Maintenance - Roads/access tracks	Dust and GHG emissions
Backfill Main Pit	
Ongoing weed control and management	N/A
Intermediate WRD - salvage rip rap	Dust and GHG emissions
Intermediate WRD - relocate to Main pit	Dust, GHG emissions and odour from contaminated material
Intermediate WRD - rehabilitate footprint	Dust and GHG emissions
Borrow Material - clean fill to bring Main Pit to final landform level	Dust and GHG emissions
Finniss River Land Trust Borrow Pit	
Prepare haul route	Dust and GHG emissions
Open Finniss River land Trust Borrow Pit	Dust and GHG emissions
Ongoing weed control and management	N/A
Rehabilitate the footprint	Dust and GHG emissions
Rehabilitate the haul road	Dust and GHG emissions
Backfill Main Pit	
Dysons Pit Overburden - salvage rip rap	Dust and GHG emissions
Dysons Pit Overburden - relocate waste above nominated drainage layer and drainage layer to Main Pit	Dust, GHG emissions and odours
Dysons Pit Overburden - install designed cover system	Dust and GHG emissions
Dysons Pit Overburden - revegetate cover system	Dust and GHG emissions
Old Main WRD - salvage rip rap	Dust and GHG emissions
Old Main WRD - relocate waste to Main Pit	Dust, GHG emissions and odours

Activity	Aspect
Place temporary (interim) liner on old WRD to protect during wet season	Dust and GHG emissions
New WSF	
Prepare Foundation	Dust and GHG emissions
Old Main WRD - relocate waste to new WSF	Dust, GHG emissions and odours
Place temporary (interim) liner on new WSF to protect during wet season	Dust and GHG emissions
Complete new drainage channel works as required and install all monitoring systems	Dust and GHG emissions
Dysons WRD - relocate waste to new WSF	Dust and GHG emissions
Dysons WRD - rehabilitate the footprint	Dust and GHG emissions
Start to place cover on new WSF - Borrow material	Dust and GHG emissions
Complete cover on new WSF - Borrow material	Dust and GHG emissions
Start to install new WSF monitoring system	Dust and GHG emissions
Revegetation of surface	Dust and GHG emissions
Complete new WRD cover and landform monitoring system - Borrow Material	Dust and GHG emissions
Creek Diversion	
Commence construction of new creek around the Main Pit	Dust, GHG emissions and odour
Contaminated soils	
Contaminated soil to be picked up and relocated to new WSF.	Dust, GHG emissions and odour
Rehabilitate the contaminated soil area footprints	Dust and GHG emissions
Old Main WRD	
Old Main WRD - rehabilitate the footprint	Dust and GHG emissions
Infrastructure	
Demobilise remaining infrastructure	Dust and GHG emissions

Table 2. Control measures to be adopted during the different phases of the project.

Control Measures	Timing	Methodology	Responsibility	Monitoring and Reporting	Performance Measure
Site preparation / planning					
All site personnel are to be informed of the requirements of this plan and the importance of air quality controls prior to accessing site	All phases	Site inductions, pre-start meeting, toolbox talks and safety shares	All site personnel	Training and induction records	All site employees attend site inductions and toolbox talks
Infrastructure					
Site setup including establishing offices, roads, pumps, power, water, sewerage and site drainage to be designed to limit the generation of dust and odours, by minimising the area of disturbance	Pre-construction phase	Factored into project risk assessment, incorporated into design and layout.	Environment Manager	Project risk assessment	Dust and odour generation identified during work risk assessment and mitigation measures adopted
Haulage, dumping and vehicle movement					
Material is to be damp prior to moving, in order to minimise dust generation	Construction phase	Dust suppression may utilise sprinklers and/or automatic sprays where a	Construction and Operations Managers	Daily inspections and monitoring of construction activities	No visible dust and no complaints.

Control Measures	Timing	Methodology	Responsibility	Monitoring and Reporting	Performance Measure
		strong likelihood of dust generation exists			
Grade unsealed sections of roads that are expecting a substantial level of use	Construction phase	Incorporate road maintenance into daily work schedule	Construction and Operations Managers	Weekly inspections	Minimal dust generation from unsealed roads.
Where possible sealed roads are to be utilised	Construction phase	Site traffic movement planned and incorporated contractor's Traffic Management Plan	Construction and Operations Managers	Weekly inspections	Minimal usage of unsealed roads where possible by heavy vehicles.
Maintain damp travel routes and material Cover truck loads	Construction phase	Water trucks used whilst carting material along unsealed roads. Where necessary and humidity levels are low sprinklers to be used on stockpiles to maintain dampness in haulage material. Where necessary truck loads will be covered during haulage	Construction and Operations Managers	Daily inspections	No visible dust off stockpiles or haulage routes.
Appropriate speed	Pre-construction and	Awareness training	Construction and	Daily inspections	No visible dust off

Control Measures	Timing	Methodology	Responsibility	Monitoring and Reporting	Performance Measure
limits to be imposed on unsealed and sealed roads	construction phase	and site inductions to highlight speed limits for the site.	Operations Managers		unsealed roads
Avoid material movement or disturbance during times of extreme weather events.	Construction phase	Weather predictions and forecasting are to be used to plan site works so as to avoid high winds and extreme weather. To be factored into work schedule. Construction works limited to 214 days per year (Dry Season)	Construction and Operations Managers	Daily inspections and monitoring for dust generation.	No visible dust.
Water treatment					
Monitor for offensive odours	Construction phase	Monitor water treatment area for any changes in sulphide related odours.	Construction and Operations Manager	Daily inspections	No offensive odours emanating from water treatment facility.
Stockpiling					
Stockpiling of materials should be away from sensitive receptors (includes offices and crib rooms)	Pre-construction	Identify suitable stockpile locations prior to construction and incorporate into work plan.	Environment Manager	Pre-construction inspection; stockpile areas clearly mapped.	No complaints from sensitive receptors

Control Measures	Timing	Methodology	Responsibility	Monitoring and Reporting	Performance Measure
Earthworks					
Vegetation clearing and topsoil stripping to be minimised during periods of high winds	Construction phase	Weather predictions and forecasting are to be used to plan site works so as to avoid high winds and extreme weather. To be factored into work schedule.	Construction and Operations Managers	Daily inspections and monitoring for dust generation.	No visible dust.
Contaminated materials handling					
Minimise potentially contaminated dusts being generated from any contaminated soils Cover trucks	Construction phase	Material is to be damp prior to moving, in order to minimise dust generation. Where necessary truck loads will be covered during haulage	Construction and Operations Managers	Daily inspections Hazardous Materials Management Plan and soil assessments	No dust generated from contaminated areas on site.
Emission Controls					
No burning of waste material on site	All phases	Site induction and awareness training	Construction and Operations Managers	Daily inspections	No fires or waste incineration on site.
Vehicle exhaust systems to be maintained.	All phases	Regular maintenance of all vehicles	Construction and Operations Managers	Maintenance records Prestart inspections Routine inspections	No smoky exhausts in operation.

Environmental Training

All personnel shall undergo air quality management awareness training as part of the site induction.

The areas to be covered will include:

- Monitoring of air quality within respective work areas
- Awareness of inclement weather conditions and its potential to degrade air quality
- The use of water trucks, misters and sprays where necessary, in order to keep dust levels to a minimum
- Covering of loads where necessary
- The notification process, where excessive dust generation is visible

All personnel accessing the site are responsible for ensuring they are in compliance with AQMP at all times whilst on site.

Legislation and Guidelines

All activities shall be carried out in accordance with relevant legislation and statutory requirements. Whilst the NT does not have specific AQ legislation, best practice will be adopted to the extent that it does not conflict with Commonwealth legislation or compromise safety.

Commonwealth Legislation

- Protection of the Environment Operations Act 1997

Northern Territory Legislation

- Waste Management and Pollution Control Act 2016
- Mining Management Act 2015

Audit and Review

The audit and review process is designed to ensure that the project maintains compliance with the AQMP. This will comprise of both internal and external audits and will consist of:

- The submission of an audit report to the DME
- Assess adequate strategies, plans and programs as required
- Recommendations for appropriate measures or action to improve the environmental performance of the project
- Amendments to be incorporated into this plan.

Cultural Heritage Management Plan

20 June 2016
Version 1.2

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Version	Date	Author	Change details
1.0	28 May 2016	Ali Youssef	First draft
1.1	18 June 2016	Ali Youssef	Incorporated comments.
1.2	20 June	Ali Youssef	Added Site Management Structure. Final.

Acronyms	
The following acronyms are used in this document	
Acronyms	Full form
AH	Aboriginal Heritage
CHMP	Cultural Heritage Management Plan
DME	Department of Mines and Energy
NT	Northern Territory
RJM	Rum Jungle Mine Site
TOs	Traditional Owners
WI	Work Instruction

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Scope

The Cultural Heritage Management Plan (CHMP) details management and prevention measures for the conservation of archaeological sites or features of cultural and European historical heritage value at the former Rum Jungle Mine Site (RJM); Rum Jungle Creek South (RJCS); Mount Burton (MB); Mount Fitch (MF); the borrow pit areas; and associated haul roads. The document outlines potential disturbance to known areas of significance and includes contingency measures to be implemented in order to reduce the potential impacts.

This document will be reviewed and updated once the construction tenders have been awarded and prior to commencement of the works.

Objective

The CHMP aims to conserve and minimise disturbance and potential impacts on all known areas of historical significance to both the region and its traditional Aboriginal owners (TOs), the Warai and the Kungarakan. It also intends to identify and protect any areas of cultural or historical significance throughout the course of the project.

Site Management Structure

The following organisation chart (Figure 1) shows the anticipated management structure for the rehabilitation program. Positions and responsibilities for the Principal Contractor and any Subcontractors are not known at this stage. Once construction tenders have been awarded, this plan will be revised in order to reflect the contractors' management structure and position responsibilities.

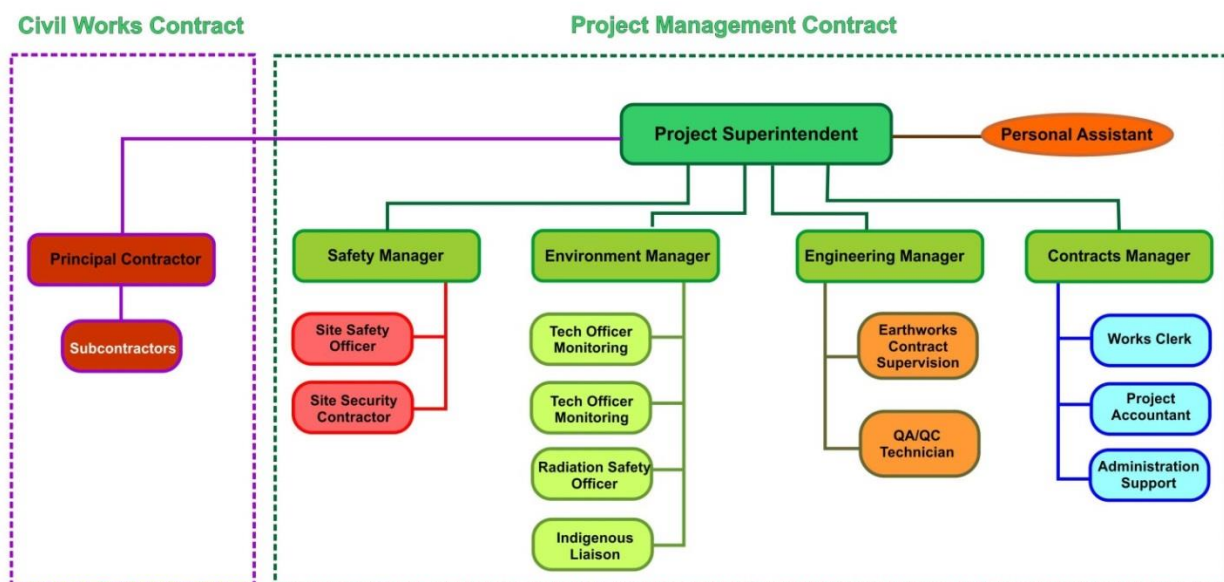


Figure 1. Organisational chart for the management of the rehabilitation project.

Potential Impacts

Archaeological and Cultural Heritage of the Site

An Aboriginal and cultural heritage assessment was completed for the Project Site by Earthsea Heritage Surveys in May 2011. Although the project site is considered relatively disturbed as a result of mining activities, one location, a quarry and artefact scatter location (RJ012), was identified as being of definite 'high significance'.

Definitions of significance ranking

All items identified during the survey have been issued with a general ranking of significance. The definitions of the significance rankings found in Tables 1 and 2, is as follows:

Low significance: These sites are unlikely to be nominated to the Territory Heritage Register as they would not satisfy any of the heritage criteria. In addition, sites in this category often occur in large numbers across the Top End landscape (i.e. isolated objects.) These sites can add to our understanding of past life ways by understanding their spatial and possibly temporal distribution. Some may demonstrate limited information about post-European settlement technologies and use of the land in the Northern Territory.

Moderate significance: These sites may have characteristics that are assessable under one or more of the heritage assessment criteria for the Territory Heritage Register; however they are unlikely to reach the thresholds necessary for permanent declaration to the list. These sites have the potential to add to our knowledge of past life ways and are still considered to have local and Territory heritage significance.

High significance: These sites may be nominated to the Territory Heritage Register and may, if assessed as of special significance, potentially be recommended for inclusion on the heritage list. These sites are considered to have significant local, Territory and National heritage value.

Site Disturbance

Under the Northern Territory' Heritage Act (2011), all Aboriginal archaeological sites are protected from damage or disturbance, including stone artefacts, rock art sites, burials, hearths and stone arrangements. Current proposed works is likely to disturb four known archaeological sites, this will necessitate them being salvaged.. These comprise of three palimpsest sites (RJ005, RJ006 and RJ007) and an artefact site (RJ009), see Table 1 and Figure 2. Work will also impact thirteen sites of heritage value (H002-H014), see Table 2, and Figure 3, comprising primarily of old mining infrastructure utilised on the site during its operative years. Disturbance of the RJM relative to identified sites is shown in Figure 4.

All efforts will be made to avoid areas of cultural or historical heritage, however construction activities still have the potential to uncover previously unknown items of archaeological significance. In such cases, appropriate procedures will be developed for the salvaging of archaeological items.

For all proposed works an Aboriginal Areas Protection Authority (AAPA) certificate will be obtained prior to their commencement, this will outline the conditions under which the proposed work may be carried out. Conditions set by AAPA are based on the advice of TOs and anthropological

investigations to protect any sacred sites in the area, it also indemnifies against prosecution under the offence provision, provided the conditions of the certificate are complied with.

Sacred sites and sites considered culturally sensitive by the Kungarakan and Warai are detailed in the AAPA certificate (C2010/296) previously acquired by DME for site characterisation investigations.

Two of the sacred sites identified in the AAPA certificate are currently impacted by previous mining activities and rehabilitation works are proposed for these sites in order to clean up the impact. The rehabilitation works proposed for the sacred sites are seen as desirable by the traditional Aboriginal land owners.

The first sacred site is the Main pit, where the original East Branch once flowed. The proposed rehabilitation will involve dewatering, backfilling and covering the Main pit, and re-instating the East Branch through the cover system. The second sacred site is a large site located in the south-east corner at Rum Jungle. The site includes part of Fitch Creek which has been heavily impacted by seepage from the Main WRD, where metal salts are expressed in the creek each dry season when the creek ceases to flow. The clean-up of these salts is proposed as part of the rehabilitation.

Mitigation measures will be put in place to ensure no unnecessary disturbance will occur at these sacred sites, all works will be focused on re-instating the areas as close to their original state as possible. The rehabilitation of the sacred sites will aid the healing of the area for the traditional Aboriginal land owners.

Table 1. List of archaeological sites and their significance.

Site ID	Site Type / Feature	Description	Disturbance proposed?	Significance
RJ001	Artefact scatter	Artefact scatter on granite outcrop - 95% quartz with some tuff. Includes broken bifacial point. Located on a flat, low outcrop, approximately 20 m x 10 m. Artefacts located in dirt / gravel around base of outcrop, probably washed from surface during wet seasons. Visibility 25% – 50%.	No	Moderate
RJ002	Artefact scatter	Artefact scatter on granite outcrop approximately 20 m x 50 m. Maximum density of 50 artefacts per square metre; average 2-3/m ² on periphery of site. 100% quartz, including broken a bifacial point and a broken retouched blade. Artefacts located in dirt / gravel around base of outcrop, probably washed from surface during wet seasons. Visibility 25% – 50%. Site located on outcrop approximately 30 m from RJ001.	No	Moderate
RJ003	Artefact scatter	Artefact scatter on end of quartz ridge near headwaters of creek. Ridge line continues north-east beyond boundary fence. Quartz outcropping with a flat ridge top approximately 8-10m wide of quartz gravel. Poor visibility (20%) thus likely to be more artefacts along ridgeline and within site. Quartz flakes- average artefact density <5/m ² .	No	Moderate – High
RJ004	Artefact scatter	Artefact scatter less than 50 m from RJ003; on open ground, less than 50 m from creek line. Quartz flakes.	No	Moderate – High
RJ005	Palimpsest	The site is on a very gentle west-facing slope less than 100 m from creek line. It has been created when subsurface artefacts were exposed by extensive erosion caused by runoff from the Main's Overburden Heap. The site is at risk of complete destruction from erosion. Material types include quartz (95% of assemblage), silcrete (1-2% of assemblage) dolerite, tuff and quartzite. Artefacts range in size from <10 mm – 200 mm; majority 20-40 mm. Imported material <20 mm. Site approximately 20 m x 30 m with maximum artefact density 80/m ² . Artefacts mainly flakes; also includes numerous unifacial points. Bower bird bowers in site; containing one quartz	Yes	Moderate – High

Site ID	Site Type / Feature	Description	Disturbance proposed?	Significance
		point and other stones which may include artefacts collected from the site.		
RJ006	Palimpsest	SE corner of palimpsest site	Yes	Moderate – High
RJ007	Palimpsest	NE corner of palimpsest site	Yes	Moderate – High
RJ008	Artefact scatter	Low density artefact scatter approximately 15 m x 15 m on quartz gravel low ridge. Overlooks low-lying area of open woodland. Average artefact density less than 6/m ² . Two broken quartz points plus quartz flakes.	No	Moderate
RJ009	Artefact scatter	Low density scatter (<1/m ²) on granite outcrop approximately 30 m x 10 m. Quartz artefacts including one retouched point and quartz flakes. Quartz varies from white to red.	Yes	Moderate
RJ010	Artefact scatter	Artefact scatter on red granite ridge overlooking creek. Low density over 15 m diameter area with maximum density of 6/m ² . Mine disturbance 30m away.	No	Moderate
RJ011	Artefact scatter	Artefact scatter on highest point of ridge with good views of surrounding hills. Apparently undisturbed by mining. Visibility 20%- likely to be more artefacts. Quartz flakes and one broken quartz point.	No	Moderate – high
RJ012	Quarry and artefact scatter	Quartz outcrop- quarry and artefact scatter on end of ridge adjacent to freshwater spring. Quarried boulders show evidence of food processing, stone artefact scatter and evidence of production of bifacial points. Highly likely to be subsurface assemblage. Visibility 10%. Low black soil swamp adjacent to site; dense riparian vegetation along spring, pandanus on flat with open woodland over rise. A single Fig tree at the end of outcrop. Cycads on low rise and quartz ridge; possibly germinated in this location as a result of food processing activity. Food processing evident on horizontal surfaces of boulders. Quartz is highly metamorphosed and is good quality for knapping. Artefacts include quartz flakes; retouched flakes, broken bifacial points, siltstone flakes (Burrell Creek Formation) and large flakes quarried from boulders ready to be used as cores. Difficult to determine	No	High

Site ID	Site Type / Feature	Description	Disturbance proposed?	Significance
		artefact density owing to poor visibility.		
I001	Isolated artefact	Quartz core	No	Low
I002	Isolated artefact	Retouched quartz flake	No	Low
I003	Isolated artefact	Broken quartz bifacial point	No	Low
I004	Isolated artefact	Quartz flake	No	Low
I005	Isolated artefact	Quartz flake	No	Low
I006	Isolated artefact	Red quartz flake	No	Low
I007	Isolated artefact	Quartz flake, retouched.	No	Low
I008	Isolated artefact	Tuff flake	No	Low
I009	Isolated artefact	Quartz flake	No	Low
I010	Isolated artefact	Retouched quartz point. Highly disturbed context.	No	Low
I011	Isolated artefact	Retouched quartz flake, perhaps bifacial preform. In bower.	No	Low

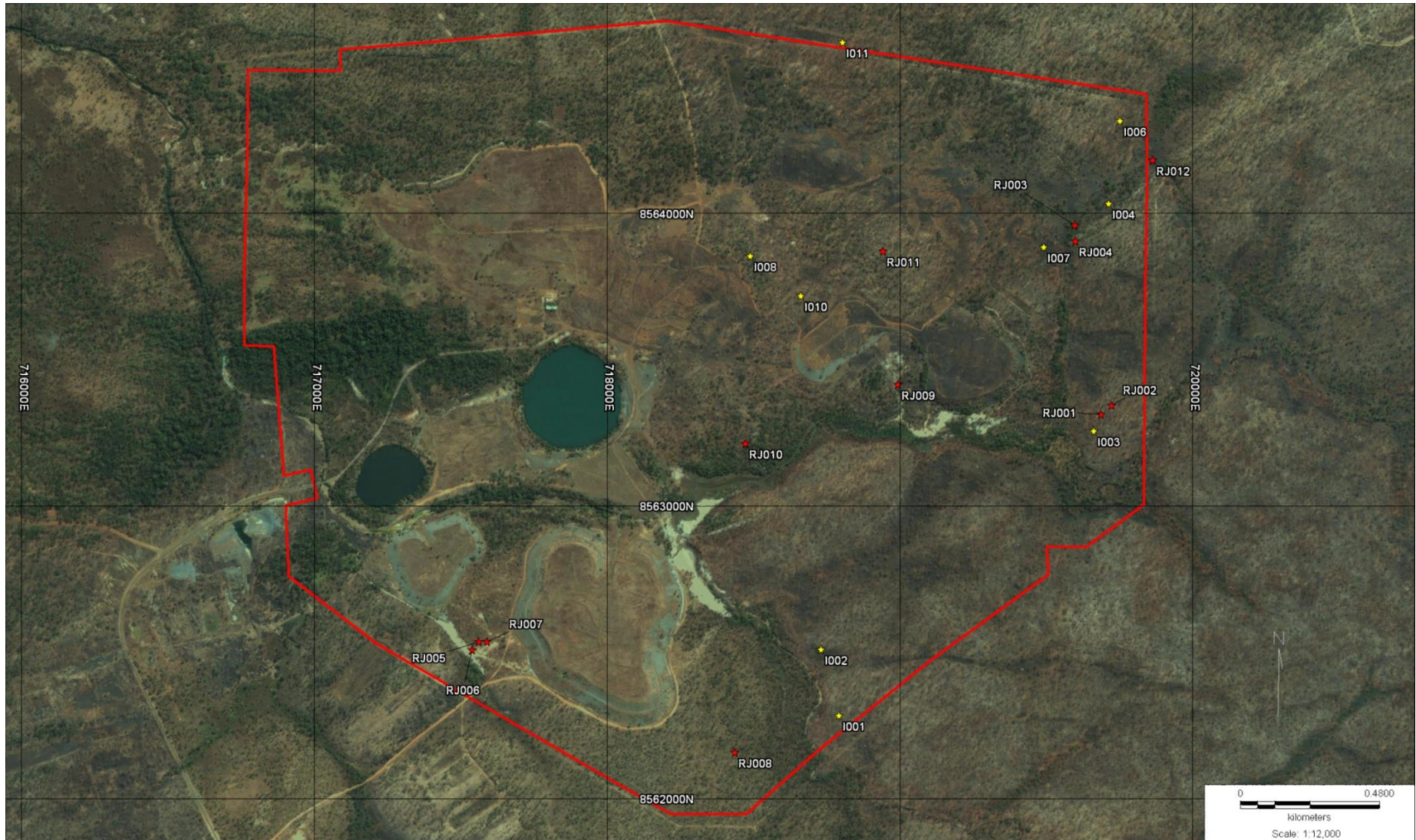


Figure 2. Aboriginal archaeological sites and isolated artefacts.

Table 2. Historic features

Site ID	Site Type / Feature	Description	Disturbance proposed?	Significance
H001	Water tank	Square concrete tank with foundations for round tank beside it. Rusty pipes and corrugated iron strewn around. Located on ridge overlooking former treatment plant site.	No	Moderate
H002	Small wooden cross with stone cairn	Probable pet grave that postdates the 1970s rehabilitation work. Occurs on earthworks in vicinity of gate house.	Yes	Low
H003	Building foundations	Includes garden edging and a variety of construction types apparently related to the visibility of each wall. Front wall constructed of concrete-capped masonry blocks. The side wall is concrete-capped mortared stone. Mortar is absent at the rear of the wall but rendered in the corner. Drainage is installed in the wall. Could be gate house or office. Rear of building foundations could not be located due to disturbance.	Yes	Moderate
H004	Dry stone wall	Corresponds with office building on Lawson's 1974 site plan. Rendered buttressed corner starting 1m from the visible end of H003. Approximately 60 m long with collapse/disturbance at 25 m (for 6 m), then quite disturbed from 40 m. Poor condition. No corners/returns noted, no capping or mortar and no visible entrances.	Yes	Moderate
H005	Ablutions Block	Demountable ablutions block featuring 3+ toilets with in-ground septic tank behind it. Was fully plumbed and powered with guttering. Probably dates to 1970s/1980s rehabilitation period. Potential Asbestos risk.	Yes	Low - Moderate
H006	Shed	Fabricating Shop. Corrugated iron construction with metal louvers and painted glass in the windows. Most windows 'boarded up' with flat sheets of galvanised tin. Some damage to corrugated iron at ground level. Damage to door frame at western end, door missing. End capping on roof appears to post-date mine operation. Sliding door missing from eastern end. Building Axis bearing of 81°.	Yes	Moderate - High

Site ID	Site Type / Feature	Description	Disturbance proposed?	Significance
H007	Shed	Workshop beside fabricating shop. Corrugated iron construction with metal louvers and painted glass in the windows. Boarded windows, as per H006. Concrete pad between sheds. Building axis bearing of 81°.	Yes	Moderate - High
H008	Concrete pad	Concrete pad in two parts. Does not correspond to anything on 1974 site plan.	Yes	Moderate
H009	Fenced area with small concrete slab	Fenced area approximately 15 m x 12 m. Concrete slab approximately 1.5 m x 1.5 m. Unknown use.	Yes	Moderate
H010	Building foundations	Large concrete slab 46.2 m x 12.5 m- in two parts. Has square concrete pads regularly spaced along edges; two of which support rusted structural remains. Probably CRA store on 1974 plan. Rubbish pile at eastern end.	Yes	Moderate
H011	Drilling Rig	Abandoned Drilling Rig, present on 1977 aerial photo.	Yes	Moderate - High
H012	Concrete slab	Concrete slab 18.9 m x 13.6 m. Slab axis on a bearing of 272°.	Yes	Moderate
H013	Concrete slabs	Two parallel concrete slabs 3.3 m apart. Each 36.7 m x 6.25 m. Correspond with core store on 1974 plan. Slab bearing on an axis of 270°.	Yes	Moderate
H014	Shed / lime storage and mixing building	Shed or lime storage and mixing building which was one of the Water Treatment Plant structures from the original mining era with a later (mid 1980s) extension. Currently used as a core store. Corrugated iron construction with metal louvers and glass windows. Extension constructed of corrugated iron and green polycarbonate corrugated sheeting. Three sliding doors on northern wall with one on south wall. Loading dock along north wall. Veranda over first loading dock door. Entrance damaged- hinged doors on ground. Building on an axis of 231°.	Yes	Moderate - High
H015	Gun	Probable WWII era rifle pit made from stone sourced in the immediate	No	Moderate

Site ID	Site Type / Feature	Description	Disturbance proposed?	Significance
	emplacement	vicinity: 2 m x 1.5 m.		
H016	Gun emplacement	Probable WWII era rifle pit made from stone sourced in the immediate vicinity: 4 m x 1.5 m.	No	Moderate
H017	Gun emplacement	Probable WWII era rifle pit made from stone sourced in the immediate vicinity: 3 m x 1.5 m.	No	Moderate
H018	Dry stone wall	Probable WWII era associated with rifle pits. Dry stone wall built between two naturally occurring rock walls. Probably used as a shelter: 2.2 m long x 0.9 m high. Artefacts include old battery and several .303 expended shells. A second dry stone wall of similar construction was later located on the last day of fieldwork close to WPO38 (quarry and food processing site). Further survey work required in conditions of better visibility.	No	Moderate



Figure 3. Historical site locations

SITE ID	DISTURBANCE PROPOSED
RJ001	NO
RJ002	NO
RJ003	NO
RJ004	NO
RJ005	YES
RJ006	YES
RJ007	YES
RJ008	NO
RJ009	YES
RJ010	NO
RJ011	NO
RJ012	NO
I001	NO
I002	NO
I003	NO
I004	NO
I006	NO
I007	NO
I008	NO
I010	NO
I011	NO
H001	NO
H002	YES
H003	YES
H004	YES
H005	YES
H006	YES
H007	YES
H008	YES
H009	YES
H010	YES
H011	YES
H012	YES
H013	YES
H014	YES
H015	NO
H016	NO
H017	NO
H018	NO



LEGEND

- RJ ARTIFACT SCATTER, PALIMPEST OR QUARRY
- I ISOLATED STONE ARTIFACT
- H EUROPEAN HISTORIC HERITAGE FEATURE
- TO REMAIN UNDISTURBED
- TO BE SALVAGED OR REMOVED

NOTE

1. SERVICES AND UTILITIES SHOWN INDICATIVELY
2. PRELIMINARY ROADS SHOWN. ROADS TO BE FINALISED.

100 50 0 100 200 300 400 500m
SCALE 1:10000

ARCHAEOLOGICAL AND EUROPEAN HERITAGE DISTURBANCE MAP
1:10,000

Figure 4. Proposed disturbance relative to known cultural or heritage sites.

Site Control Measures

An operational table has been included in Table 3, below; this highlights the site conservation management strategy which includes Measures to conserve the Indigenous archaeological sites, World War II and mining features during the construction works, include;

- Where possible former mining structures or equipment will be nominated to the Northern Territory Heritage Register for assessment by the Heritage Advisory Council;
- All site employees will be provided with a cultural heritage induction that will communicate effectively the Indigenous and historic cultural values of the area. All cultural heritage inductions will include an Indigenous representative;
- Ongoing communication regarding the rehabilitation and heritage conservation works will be undertaken with TOs;
- Controlled access by the general public to the mine site area will remain, to prevent trespassing on sacred sites and sites considered culturally significant and/or sensitive, and interference with heritage sites;
- Development of procedures for unexpected finds to be developed prior to construction. To include information on the notification process and the salvaging of finds;
- TO representation where field work relating to cultural heritage is required
- To notification prior to any further archaeological surveys of the impacted areas.

Table 3. Control measures to be adopted during the different phases of the project.

Control Measure	Timing	Methodology	Responsibility	Monitoring and Reporting	Performance Measure
Site Preparation / Planning					
Protection of known cultural heritage areas and procedures for unexpected finds.	Pre-construction phase	Mitigation measures to be included in work instructions (WI) where activities may uncover new heritage sites or to work nearby existing protected areas. Site layout to avoid known sensitive areas. If likely to be impacted, archaeological sites will be salvaged	Environment Manager	WI or Standard operating Procedures (SOP)	Items of historical or cultural significance identified and protected in the planning phase.
Training					
Training is to be provided to all site personnel to educate on cultural heritage areas and items and procedures for handling an unexpected find.	Pre-construction and construction phase (dependant on individual's commencement date)	New staff, contractors and visitors will all undergo a site induction prior to accessing site. This will incorporate legal responsibilities as it pertains to areas and	Construction and operations Manager; and Environment Manager	Site induction records Toolbox attendance records.	Personnel aware of cultural heritage sites and the importance they hold to the TOs. Cultural heritage sites remain protected.

		<p>items of cultural and heritage significance.</p> <p>Regular awareness sessions will be given as part of toolbox talks, covering cultural heritage matters.</p> <p>Site inductions and awareness sessions to include:</p> <p>Background on cultural heritage for the project area;</p> <p>The significance of cultural heritage places and sacred sites</p> <p>Legal framework for cultural heritage protection</p> <p>Location of known areas of cultural heritage</p> <p>What to do in the event a new cultural heritage area is discovered</p> <p><i>Pro forma</i> stating that employees</p>			
--	--	--	--	--	--

		understand the content of site induction and will abide by all site procedures and applicable legislation.			
Vegetation Clearing, Construction and Demolition					
Monitoring of high risk activities or areas using TO monitors	Construction phase	TOs to be engaged in construction activities and clearing especially in areas where there is a high likelihood of activities uncovering areas or items of cultural significance.	Environment Manager Construction and Operations Manager	Scope of works Field monitoring sheets	Cultural monitoring incorporated into high risk activities.
Protection of salvaged finds	Construction phase	Salvaged items to be reburied in TO approved area or stored / displayed at areas agreed to by TOs. Approach will need to be agreed upon prior to construction.	Environment Manager	Archaeological records	Management of salvaged artefacts implemented in accordance with the wishes of the TOs.

Legislation and Guidelines

All activities shall be carried out in accordance with relevant legislation and statutory requirements.

Commonwealth Legislation

- Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)
- The Commonwealth Aboriginal and Torres Strait Islander Heritage Protection Act (1984)

Northern Territory Legislation

- NT Heritage Act (2011)
- NT Aboriginal Sacred Sites Act (1989)

Guidelines

- Ask First: A guide to respecting Indigenous heritage places and values (2002);
- *Australia ICOMOS Charter for Places of Cultural Significance, The Burra Charter, 2013* (Burra Charter)

Audit and Review

The audit and review process is designed to ensure that the project maintains compliance with the CHMP. This will comprise of both internal and external audits and will consist of:

- The submission of an audit report to the DME
- Assess adequate strategies, plans and programs as required
- Recommendations for appropriate measures or action to improve performance of the project
- Amendments to be incorporated into this plan.

References

Martin-Stone, K. and Wesley, D.; *Archaeological Survey and heritage Assessment of the former Rum Jungle Mine Site, Northern Territory* (2011), Earthsea Heritage Surveys, Darwin.

Environmental Occupational Health and Safety Management Plan

20 June 2016
Version 1.2

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1.2	20 June 2016	Ali Youssef	Added Site Management Structure section. Final.

Acronyms	
The following acronyms are used in this document	
Acronyms	Full form
EBFR	Eastern Branch of the Finnis River
EMP	Environmental Management Plan
EOHSMP	Environmental Occupational Health and Safety Management Plan
NT	Northern Territory
OHS	Occupational health and Safety
WSF	Waste Storage Facility

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Scope

The Environmental Occupational Health and Safety Management Plan (EOHSMP) is designed to address the management, monitoring and assessment of site occupational health and safety in relation to the Environmental Management Plan (EMP) to be implemented at the site throughout all phases of the proposed activities. It refers to prevention and mitigation measures associated with the construction works at Rum Jungle Mine Site (RJM) and its satellite sites of Rum Jungle Creek South (RJCS), Mount Fitch and Mount Burton and Borrow Areas. The EOHSMP identifies the relevant management plans under which Occupational Health and Safety (OHS) issues are incorporated for site environmental management strategies.

This document will be reviewed and updated once the construction tenders have been awarded and prior to commencement of the works.

Objective

Minimise the potential risk to project personnel and the general public, as well as the surrounding environment from site activities relating to the Rum Jungle Rehabilitation Project. The EOHSMP associates the relevant environmental management activities with OH&S risks, and identifies the requirements for OH&S to be provided by the Principal Contractor so it is aligned with the environmental management framework and EMP.

Site Management Structure

The following organisation chart (Figure 1) shows the anticipated management structure for the rehabilitation program. Positions and responsibilities for the Principal Contractor and any Subcontractors are not known at this stage. Once construction tenders have been awarded, this plan will be revised in order to reflect the contractors' management structure and position responsibilities.

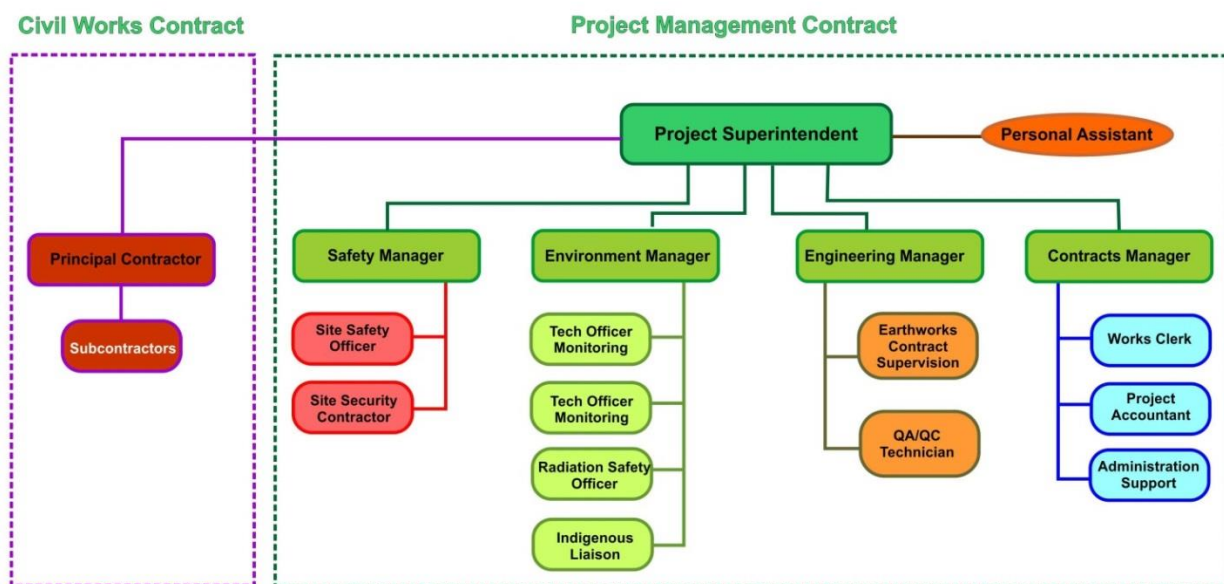


Figure 1. Organisational chart for the management of the rehabilitation project.

Site OH&S Management

Rehabilitation Engineering Design

Detailed engineering plans were designed for the preferred rehabilitation strategy for the RJM and satellite sites. The detailed engineering designs are outlined in the report by O'Kane's Engineering Consultants: 'Batchelor Region - Former Rum Jungle Mine; Site Rehabilitation Detailed Design Report, 2015'.

Rehabilitation Project Works

The final proposed Engineering Design and Construction Plan involves the main general landform and construction elements:

Landform	General Activity
Main Pit	<ul style="list-style-type: none">• Dewatering of Main Pit• Removal of Residual Tailings• Water treatment for pit water• Groundwater pumping• Backfilling and capping
Intermediate Pit	<ul style="list-style-type: none">• To be left open post rehabilitation• New inflow and outflow to be designed
Dyson's Backfilled Pit	<ul style="list-style-type: none">• Contaminated overburden to be removed to ground level and relocated in new Waste Storage Facility (WSF) and the Main Pit• Existing tailings to be covered with store and release cover system
Main Waste Rock Dump (WRD)	<ul style="list-style-type: none">• Waste rock to be relocated to in new Waste Storage Facility (WSF) and the Main Pit• Footprint to be recovered, landscaped and revegetated
Main North Waste Rock Dump	<ul style="list-style-type: none">• Waste rock to be relocated to in new Waste Storage Facility (WSF)• Footprint to be recovered, landscaped and revegetated
Intermediate Waste Rock Dump	<ul style="list-style-type: none">• Waste rock to be relocated to in the Main Pit• Footprint to be recovered, landscaped and revegetated
Dyson's Waste Rock Dump	<ul style="list-style-type: none">• Waste rock to be relocated to in new Waste Storage Facility (WSF) and the Main Pit• Footprint to be recovered, landscaped and revegetated
Old Tailings Dam	<ul style="list-style-type: none">• Residual contamination to be relocated to in new Waste Storage Facility (WSF)• Footprint to be recovered, landscaped and revegetated
Copper Extraction Area	<ul style="list-style-type: none">• Residual contamination to be relocated to in new Waste Storage Facility (WSF)• Water pumping and treatment for heavily impacted

Landform	General Activity
	<ul style="list-style-type: none"> groundwater • Footprint to be recovered, landscaped and revegetated
Old Stockpiled Area	<ul style="list-style-type: none"> • Residual contamination/waste rock to be relocated to in new Waste Storage Facility (WSF) • Footprint to be recovered, landscaped and revegetated
Borrow Area 5	<ul style="list-style-type: none"> • Revegetated area to be managed and monitored
East Branch Finniss River (EBFR)	<ul style="list-style-type: none"> • Realignment of the EBFR close to its original position, around the back filled Main pit, through the Copper Extraction Area and Intermediate Pit
Finniss East Branch Diversion channel (EFDC)	<ul style="list-style-type: none"> • Residual contamination to be removed and channel and embankments to be altered to allow for greater flow and adjustments to surrounding landforms • Instillation and removal of a bridge for hauling waste rock
Acid and Sweetwater Dam Area	<ul style="list-style-type: none"> • Residual contamination to be removed and channel to be altered to allow for greater flow and adjustments to EBFR
New Waste Storage Facility (WSF)	<ul style="list-style-type: none"> • Clearing of vegetation and stockpiling of soils and vegetation • Construction of new WSF including appropriate drainage • Lime treatment of waste rock • Water treatment of run off and seepage from landform • Covering and revegetation of new landform • Construction and decommissioning of haul roads
Water Treatment Plant	<ul style="list-style-type: none"> • Construction of water treatment plant and associated infrastructure • Ongoing water treatment and disposal of residual water treatment wastes prior to and during construction • Decommissioning of Water Treatment Plant
Haul Roads	<ul style="list-style-type: none"> • Clearing of vegetation and stockpiling of soils and vegetation • Construction of haul roads and suitable drainage • Decommissioning of haul roads and rehabilitation of areas
Borrow Areas	<ul style="list-style-type: none"> • Clearing of vegetation and stockpiling of soils and vegetation • Removal of borrow materials and suitable drainage • Landscaping of proposed borrow areas and revegetation
Proposed Site Facilities	<ul style="list-style-type: none"> • Construction of proposed site facilities • Installation of services for facilities • Storage of materials and fuels • Decommissioning of proposed site facilities and services and rehabilitation of areas
Mount Burton	<ul style="list-style-type: none"> • Removal of waste rock and general waste from mine site to proposed WSF • Landscaping and revegetation of WRD footprint
Mount Fitch	<ul style="list-style-type: none"> • Removal of waste rock and general waste from mine

Landform	General Activity
	site to proposed WSF <ul style="list-style-type: none"> • Backfilling of minor excavation pit • Landscaping and revegetation of WRD and excavation pit footprint

The Principal Contractor will be responsible for the site rehabilitation management and will produce a detailed OHS plan relating to the specific site construction activities for the rehabilitation project. Suitable policies and procedures must be in place for managing site safety. These will be part of an overall management system.

An OHS system will include processes for:

- Identifying persons with OHS responsibilities
- Managing the health and safety of contractors and sub-contractors
- Developing and manage consultation procedures for health and safety matters
- Identifying hazards and control risks
- Establishing the location of underground services
- Developing site safety rules
- Monitoring site activities and enforcement of safety rules
- Establishing site amenities and implement ongoing maintenance
- Developing site specific induction for workers and irregular site visitors
- Ensuring only trained and competent workers are allowed to work on-site
- Ensuring all plant (machinery and equipment) is safe and without risks to health before use
- Identifying requirements for a mobile plant compound and vehicle parking
- Developing traffic management plans
- Identifying and control risks to the public
- Developing emergency response plans for reasonably foreseeable emergency situations.

(A Guide to Managing Safety Civil Construction Industry Standard, Worksafe VIC, 2012)

Potential Impacts

The potential impacts from OH&S risks to human health and the environment are based on site activity, and where these OH&S risks occur they should give consideration to the requirements of the environmental management framework. The individual Management Plans within the environmental management framework are:

- Environmental Management Plan [lead document] (EMP)
- Biodiversity Management Plan (BMP)

- Radiation Management Plan (RMP)
- Hazardous Substances and Dangerous Goods Management Plan (HSDGMP)
- Environmental Occupational Health and Safety Management Plan (EOHSMP)
- Water Management Plan (WMP)
- Air Quality Management Plan (AQMP)
- Noise and Vibration Management Plan (NVMP)
- Cultural Heritage Management Plan (CHMP)

The Principal Contractors OHS Management Plan shall implement policies and procedures in line with the above management plans, and also include OHS considerations relating to:

- Policy and commitment to protect the environment from adverse impacts
- Ensure that personnel are trained and/or instructed to understand and comply with environmental policies
- Comply with environmental legal requirements in relation to OHS and the environment
- Implement dust control measures
- Utilise noise and vibration management controls to minimise disturbance
- Minimise quantities of waste generated and determine its hazard rating and type
- Recycle waste where possible
- Minimise disturbance activities where required
- Protect native ecosystems and control the propagation of weed species
- Prevent pollution of any surface and ground water
- Maintain spill control and clean up equipment
- Ensure the handling, storage, treatment, transportation, and disposal of waste is done in an environmentally responsible manner that complies with the relevant legislation
- Storage, handling, transport and disposal of hazardous materials and dangerous goods
- Review and comply with air pollution legal requirements
- Have a management system in place to deal with uncontrolled discharges or spills that could potentially impact human health and the environment
- Comply within trigger values for environmental emissions
- Have a procedure in place to deal with workforce and public complaints and incident reporting

Corrective Actions

All personnel are to notify the site environment, or health and safety manager in the event of an incident relating to environmental procedures, uncontrolled spills, exposure or release of a pollutant.

In the event of an OHS incident, uncontrolled spill, exposure or release of a pollutant the personnel involved will be required to fill in an Incident report with the Health and Safety or Environmental or manager as soon as is practicable, and report this to the site manager;

Weekly reports will be provided to the site manager by the site Health and Safety manager in relation to any instances or occurrences relating to the OHS non-compliance NS follow up actions, and will ensure all correspondence and documentation is correctly managed and all public and occupational safety directives and legislation is properly enforced and reported;

Legislation and Guidelines

All activities shall be carried out in accordance with relevant legislation and statutory requirements. Whilst the NT does not have specific OHS legislation, best practice will be adopted to the extent that it does not conflict with Commonwealth legislation or compromise safety.

Commonwealth and International Legislation

Commonwealth Work Health and Safety Act 2011

Commonwealth Work Health and Safety Regulations 2011

Australian Radiation Protection and Nuclear Safety Act 1998

Northern Territory Legislation

Northern Territory Of Australia, Work Health And Safety (National Uniform Legislation) Act 2016

Northern Territory Of Australia, Dangerous Goods Act 2012

Northern Territory Of Australia, Dangerous Goods Regulations, 2015

National Standard for the Storage and Handling of Workplace dangerous Goods [NOHSC:1015(2001)].

Northern Territory Of Australia, Waste Management And Pollution Control Act 2016

Northern Territory Of Australia, Waste Management And Pollution Control (Administration) Regulations 2014

Code of Practice and Guidelines

Safe Work Australia WHS National Codes of Practice for Construction Industry (multiple)

National Code of Practice for the Storage and Handling of Workplace Dangerous Goods [NOHSC: 2017 (2001)]

Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing 2005

Australian Dangerous Goods Code 2016

Asbestos Disposal in the Northern Territory Guidelines

Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites in the Northern Territory 2013

Code of Practice for the Management and Control of Asbestos 2005

Code of Practice for the Safe Removal of Asbestos 2005

Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia (WA Department of Health, 2009)

Audit and Review

A biannual report on OHS will be supplied by the principal contractor's site manager on the status of OHS management to the NT Regulator Worksafe NT. A revision of associated documentation, procedures and policies on the management of hazardous substances and dangerous goods will ensure continued implementation of industry best practice. Update all documentation and ensure they are available and in an accessible location to all personnel for reference.

Where documentation has been updated, all relevant personnel will be informed of the impacts in relation to OHS, the environment, and its relevance to their position.

Hazardous Substances and Dangerous Goods Management Plan

20 June 2016
Version 1.3

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Version	Date	Author	Change details
1.0	23 May 2016	Mark Greally	First draft
1.1	18 June 2016	Ali Youssef	Incorporating all review comments.
1.2	18 June 2016	Mike Fawcett	Restructure, additional text and edits
1.3	20 June 2016	Ali Youssef	Formatting and addition of Site Management Structure. Final.

Acronyms The following acronyms are used in this document	
Acronyms	Full form
DG	Dangerous Goods
DME	Department of Mines and Energy
HS	Hazardous Substances
HS&DGMP	Hazardous Substances and Dangerous Goods Management Plan
MSDS	Material Safety Data Sheet

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Scope

The Hazardous Substances and Dangerous Goods Management Plan (HS&DGMP) details management measures for Hazardous Substances (HS) and Dangerous Goods (DG) during the rehabilitation works at Rum Jungle Mine site and its satellite sites of Mount Fitch, Mount Burton, associated haul roads and the Borrow Area located on the Finnis River Land Trust.

The document outlines control measures to be implemented during the storage, use and disposal of HS and DG. It allows for the mitigation of potential impacts associated with HS and DG, where the potential for an uncontrolled release or exposure is possible.

This document will be reviewed and updated once the construction tenders have been awarded and prior to commencement of the works.

Dangerous goods are classified on the basis of immediate physical or chemical effects, such as fire, explosion, corrosion and poisoning that might affect property, the environment or people. Petrol, pool chlorine and some pesticides are examples.

Hazardous substances are classified on the basis of health effects, whether immediate or long-term, particularly in relation to workplaces. For example, exposure to hazardous substances can cause adverse health effects such as asthma, skin rashes, allergic reactions, allergic sensitisation, or cancer and other long-term diseases.

Objectives

The objectives of the HS&DGMP are to:

- Reduce the risk of personnel on site being exposed to substances that may adversely affect their health or safety.
- Mitigate against potential environmental impacts (terrestrial and aquatic) associated with the movement, storage, use and disposal of HS and DG.
- Transport, receive, store, utilise and dispose of HS and DG in an appropriate manner.
- Ensure the proper treatment and disposal of substances as required.

Site Management Structure

The following organisation chart (Figure 1) shows the anticipated management structure for the rehabilitation program. Positions and responsibilities for the Principal Contractor and any Subcontractors are not known at this stage. Once construction tenders have been awarded, this plan will be revised in order to reflect the contractors' management structure and position responsibilities.

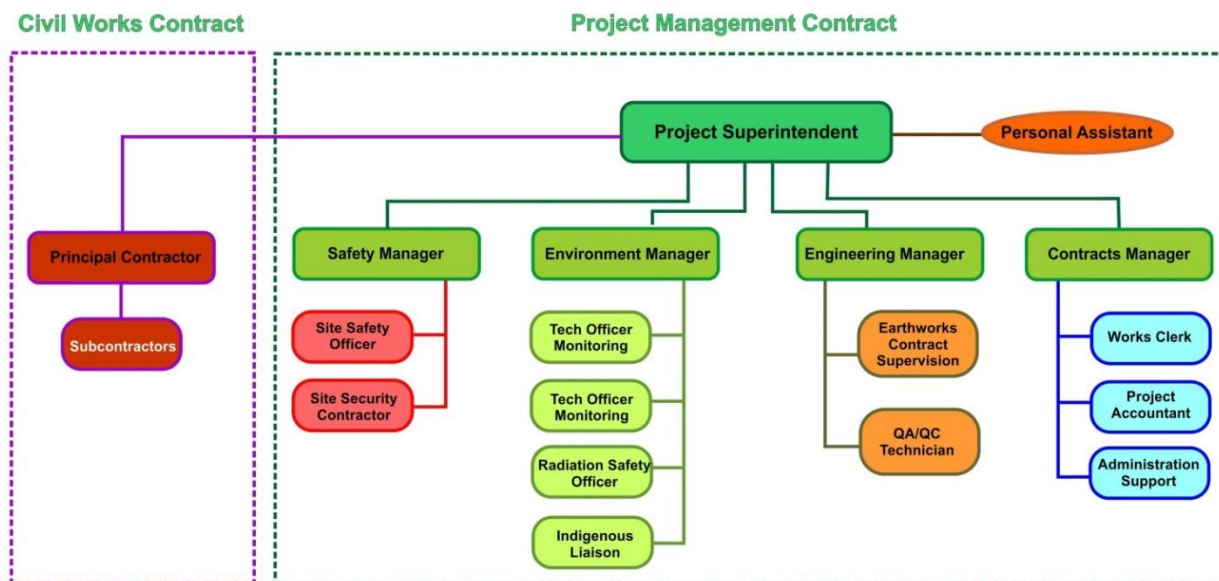


Figure 1. Organisational chart for the management of the rehabilitation project

In the interim, typical responsibilities relating to positions are provided following:

Employees and contractors

- Assess the workplace and work task for hazardous substances before commencing any work.
- Ensure that, when applicable, engineering and administrative controls and Personal Protective Equipment (PPE) shall be in place during handling of hazardous substances.

Supervisors and Managers

- Ensure that employees have the knowledge and proper training in handling of hazardous substances that will be encountered during the execution of work.
- Ensure that Materials Safety Data Sheets (MSDS) are available to the workers in the work area throughout each work shift.
- Submit 'Request to bring hazardous substance on site' forms and seek approval from the Project Superintendent prior to mobilising new chemicals to site.
- Update as required the MSDS Register for their respective areas.
- Forward a copy of the updated register to the Safety Manager to be included in the site wide MSDS Register.

Safety Manager

- Provide guidance for the assessment of hazardous substances and dangerous goods and recommendations for controls.
- Facilitate HS and DG assessments and audits as and when required.
- Site wide hazardous substances register custodian.

Control Measures

The following control measures have been assessed for all site aspects which pertain to the usage of HS and DG due to the use of fuels and chemicals as part of the rehabilitation project.

Table 1. Control measures to be adopted during the different phases of the project.

Control Measures	Timing	Methodology	Responsibility	Monitoring and Reporting	Performance Measure
Storage of HS and DG					
HS and DG will be suitably stored in designated areas, away from sensitive receptors.	All phases	Storage locations will be away from high traffic areas and environmentally sensitive areas As per Dangerous Goods Act and Regulations and Guidelines (see Legislation Section)	Safety Manager Construction and Operation Managers All personnel on site are responsible for ensuring they are in compliance with HS and DG management policies as provided by the principal contractor during site inductions. Site management may delegate specific staff, management of individual areas or particular Hazardous Substances based on activities or usage.	Site supervisors will regularly check Hazardous Substances in storage to ensure that the correct labelling storage, stock levels are implemented All personnel to notify the site Safety Manager in the event of a spill, exposure or release of a HS or DG Compliance reports to be provided to the Safety Manager by the relevant supervisors on a yet to be determined schedule.	No releases of HS and DG Regular updating and quarterly review of HS and DG Inventory Suitable management, containment and disposal measures are implemented in the eventuality of a release.

Control Measures	Timing	Methodology	Responsibility	Monitoring and Reporting	Performance Measure
Bunding to be maintained to preserve holding capacity	Pre-construction and construction phases	Bunds to be pumped of chemicals and accumulated water and disposed of appropriately	Construction and operation managers	Weekly inspections	Bunds maintain full holding capacity and remain clean of debris
Copies of Material Safety Data Sheets (MSDS) for all Hazardous Substances to be maintained on-site at relevant designated locations	All phases	As per Dangerous Goods Act and Regulations and Guidelines (see Legislation Section) All MSDSs to be included in site HS and DG register	Safety Manager Construction and operation managers Site supervisors	MSDS to be included in all relevant OH&S documents Site supervisors will regularly check and monitor MSDS information is updated	Regular review by Construction and operation of all activities relating to HS and DG. No items stored without appropriate MSDS lodged in site register and made available to users No items used without accompanying MSDS.
Spill kits available at all permanent HS and DG storage areas	All phases	All storage areas to have appropriate spill kits provided.	Construction and operation managers Site supervisors	Risk assessments Weekly inspections	Spill kits are fully stocked and appropriate for storage area
Emergency procedures regarding	Pre and construction Phase	Utilise spill response procedures for	Construction and operation managers	Monitoring activities and use of spill kits	No spills or incidents with the potential to

Control Measures	Timing	Methodology	Responsibility	Monitoring and Reporting	Performance Measure
spillage containment made visible with adequate signage		chemicals and fuels to be developed.	Site supervisors		cause environmental harm.
Use of HS and DG					
Fuel handling will be undertaken only at approved locations and spill prevention and clean up equipment and training will be made available	All phases	All areas of fuel handling, storage and refill Spill kit made available at fuelling point Procedure for refuelling to be made visible	Construction and operation managers Site supervisors	Construction and operation management will provide and implement a Fuel Management Plan Site supervisors will routinely visually check fuel handling locations for fuel spillages	No fuel spillages. Suitable management, containment and disposal measures are implemented in the eventuality of a release. Refuelling conducted according to procedures.
All waste classified as dangerous or hazardous be removed or disposed to an appropriately licenced waste facility, in line with MSDS.	All phases	As per appropriate regulations and guidelines (see Legislation, Guidelines and Standards section) Hazardous substances/Dangerous Goods Register	Safety Manager Construction and operation managers Site supervisors	Regular review and audits of activities and operations associated with HS and DG to ensure compliance. Hazardous substances/Dangerous Goods Register	No releases into the environment. Ensure all HS and DG waste appropriately removed by a licenced contractor to an appropriate facility. Managers and Supervisors will

Control Measures	Timing	Methodology	Responsibility	Monitoring and Reporting	Performance Measure
					undertake risk assessment of HS and DG when planning site works
Identify and register all known environmental and human health risks associated with HS and DG for proposed activities and processes	Pre-construction All phases	As per Dangerous Goods Act and Regulations and Guidelines (see Legislation Section)	Construction and operation managers Site supervisors	Include activities involving HS and DG in OH&S Safety Plans and Job Safety Analysis (JSA) Plans Risks associated with Hazardous Substances will be reviewed when conditions of handling or storage change	All HS and DG on site are recorded in site register. All HS and DG on site have correct MSDS's recorded in the register. Register is up to date. No incidents relating to HS and DG occur.
Clearly define roles and responsibilities in relation to the handling, storage and inspection of HS and DG	Pre-construction All phases	Designate personnel during site operations with responsible for dangerous goods management	Safety Manager Principal Contractor's designated staff	Safety Manager will regularly review and audit to ensure roles and responsibilities for HS and DG are up to date.	All roles and responsibilities clearly defined and incorporated in job descriptions.
Works will be designed to ensure handling , storage	Pre-construction	As per Dangerous Goods Act and Regulations and	Environment Manager	A risk assessment of Hazardous Substances will be included in	Suitable management, containment and

Control Measures	Timing	Methodology	Responsibility	Monitoring and Reporting	Performance Measure
and disposal of Hazardous Substances and wastes are fit for purpose and meet appropriate standards;		Guidelines (see Legislation Section)		detailed operational design reports	disposal measures are implemented in the eventuality of a release
An Asbestos Management Plan (AMP) and register maintained and regularly updated. Management and disposal of all asbestos containing materials undertaken by suitably trained and licenced personnel.	All Phases	As per Legislation and Guidelines pertaining to Asbestos (see Legislation Section)	Safety Manager Construction and operation managers	Site management will conduct and regularly review any Asbestos Register and update it when charges are made The AMP reviewed annually or when significant changes occur onsite relating to asbestos. OH&S monitoring relating to asbestos will be reported and reviewed at regular site management meetings during operational phases.	Asbestos containing materials are not unnecessarily disturbed by site activities Asbestos registers are regularly reviewed and updated. All asbestos containing materials disposed of by suitably trained and licenced personnel.
Personnel to be trained in the use of spill kits	Pre-construction	Site inductions Toolbox talks	Construction and operation managers Site supervisors	Inductions and training attendance and records	Personnel react promptly and in an appropriate manner when dealing with a

Control Measures	Timing	Methodology	Responsibility	Monitoring and Reporting	Performance Measure
				Spill reports	spill incident.

Pollution Response

The Principal Contractor who will manage the site during construction and operational phases will produce a Pollution Incident Response Management Plan or similar document, as part of their overall Emergency Response Management Procedures and/or in conjunction with the Principal Contractors Waste Management Plan.

The pollution response will comply with NT *Waste Management and Pollution Control Act 2016* and the *Dangerous Goods Act* and Regulations and Guidelines.

The pollution response management will include the following major requirements:

- Full and timely reporting of a pollution incident to site management, site personnel, and all relevant authorities.
- Minimise and control the risk of a pollution incident by identifying the risks and developing planned actions to minimise and manage the associated risks.
- Ensure that the plan is appropriately applied by trained staff, identifying persons responsible for implementing it, and ensuring that the plan is regularly tested for accuracy, timely relevance and appropriateness.

Risk Assessment

A documented risk assessment shall be conducted prior to working with hazardous substances or dangerous goods and repeated any time the scope of work changes or any surrounding conditions change. The risk assessment shall include as a minimum:

- Potential for personnel to be adversely affected by the hazardous substances.
- Other work that may be occurring simultaneously in adjacent areas.
- Selection of appropriate control measures using the hierarchy of controls.
- Potential for weather or other external conditions to influence the work with hazardous substances (e.g. wind, rain, dust, gases, poor lighting, temperature etc.).
- Selection of appropriate equipment for undertaking the works.
- Selection and use of appropriate Personal Protective Equipment (PPE).
- Disposal of waste and unused hazardous substances that may be generated or recovered.
- Environmental procedures for incidents such as spill.
- Emergency procedures in the event of an incident.

The completed risk assessment shall be provided to the Safety Manager or the Principal Contractors designated Manager for approval prior to any work with hazardous substances commencing.

Hierarchy of Controls

The hierarchy of controls outlines the preferred hierarchy of controlling exposures to hazardous substances. In order of preference the hierarchy is: elimination, substitution, isolation, engineering, administration, and PPE. PPE is considered to be the last line of defence in protecting personnel from hazardous substances and must be provided to all personnel at risk of exposure to hazardous substances.

Elimination

Eliminating either the substance or the activity which gives rise to the risk is the most effective form of risk reduction.

Substitution

Substituting high risk products or activities with alternative lower risk products or activities will reduce overall risk exposure. An example of substitution would be using non-dangerous goods in place of dangerous goods, such as degreasing with detergent instead of a chlorinated or volatile solvent.

Isolation

Hazards may be isolated by distance or barriers or a combination of both. Factors to consider in determining separation distances include:

- The types of hazardous substances and the risks they pose to adjacent areas.
- The quantity of hazardous substances stored and handled.
- Other activities occurring in the work area, which may increase the risk

Engineering

Engineering controls involve making engineering changes to a process or piece of equipment used to store or handle hazardous substances or to an operation or activity that may be exposed to hazardous materials. Examples include:

- Providing adequate ventilation, including local exhaust ventilation, to eliminate flammable or harmful atmospheres.
- Providing adequate spill control to cope with the largest foreseeable spill..
- Incorporating suitable devices to protect installations from external hazards.

Administration

Administration controls consist of properly designed and implemented work practices and procedures and may include:

- Safe work procedures that describe the correct methods for performing all activities associated with storing, working with and disposing of dangerous goods.
- Inductions and ongoing training and supervision to provide the necessary knowledge and skill and ensure correct procedures are followed.
- Good housekeeping, reinforced by regular formal auditing and workplace monitoring to ensure safe working conditions are maintained.

Personal Protective Equipment

PPE is considered the last line of defence against hazardous substances. MSDS's contain recommendations on the selection and use of PPE for the particular materials being used. Managers and Supervisors shall ensure that:

- Protective devices are selected which are suitable for the individual and give the required level of protection from the risks associated with the particular task.
- The PPE selected meets relevant Australian Standards.

- The use of appropriate correct PPE is enforced.
- PPE is readily available, clean and functional, and employees are individually fitted
- All staff is given appropriate instruction on the need for, and correct use of PPE.
- An effective system of cleaning and maintenance for PPE is provided and implemented.

Authorisation for Entry and Removal of Hazardous Substances

Hazardous substances required to be brought to site must first have written approval from the Safety Manager prior to transport and use on site. This ensures that the products are reviewed for potential risks to health and the environment.

All hazardous substances supplied or introduced to the site are required to be accompanied by a MSDS, copies of which shall be located both where the hazardous substance is being used and where it is stored.

The Safety Manager shall maintain an inventory (Hazardous Substance Register) for each separate hazardous substance storage area on site. The inventory and accompanying MSDS's shall be available for viewing by all personnel.

No asbestos or asbestos containing substances shall be brought onto site.

No radioactive substances or equipment containing or requiring radioactive sources for operation shall be brought onto site without approval from the Project Superintendent.

The Safety Manager is responsible for ensuring that all waste and unused hazardous substances are removed from site in accordance with legislative requirements.

Documented details of such disposal shall be forwarded to the Safety Manager for approval prior to disposal and records of all chemical disposals retained for inspection and audit.

Training

All personnel required to work with hazardous substances shall, prior to commencing any work, have completed suitable training and have been assessed as competent by the appropriate manager.

Training and/or instruction in the safe use, storage and handling of hazardous substances shall be identified in accordance with the relevant MSDS and carried out for all personnel required to work with hazardous substances.

Training may consist of, but not be limited to:

- Formal industry or external training.
- Formal onsite training.
- On the job training.

Assessment of training records must be made by a competent person to determine whether a person is competent to carry out work with hazardous substances.

Records of all training and competency assessments are to be maintained in a register and be shall be provided to the appropriate supervisor prior to commencing any work with hazardous substances.

A documented risk assessment and Job Safety Analysis (JSA) shall be conducted prior to any work with hazardous substances commencing.

All personnel accessing the site are responsible for ensuring they are in compliance with HS and DG management policies, training and follow signage, handling instructions and JSA's as provided by the Principal Contractor during site inductions.

Legislation and Guidelines

Commonwealth Legislation

Australian Radiation Protection and Nuclear Safety Act (1998)

Work Health and Safety Act 2011

Work Health and Safety Regulations 2011

Northern Territory Legislation

Dangerous Goods Act, 2012

Dangerous Goods Regulations, 2015

Waste Management and Pollution Control Act, 2016

Waste Management and Pollution Control (Administration) Regulations 2014

Work Health and Safety (National Uniform Legislation) Act 2016

Codes of Practice, Guidelines and Standards

- National Code of Practice for the Storage and Handling of Workplace Dangerous Goods [NOHSC: 2017 (2001)].
- Code of Practice and Safety Guide for Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing (2005).
- Australian Dangerous Goods Code 2016.
- Asbestos Disposal in the Northern Territory Guidelines.
- Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites in the Northern Territory 2013.
- Code of Practice for the Management and Control of Asbestos (2005).
- Code of Practice for the Safe Removal of Asbestos (2005).
- National Standard for the Storage and Handling of Workplace dangerous Goods [NOHSC:1015(2001)].

- AS 1940:2004 Storage and Handling of Flammable and Combustible Liquids.
- AS/NZS 4452:1997 Storage and Handling of Toxic Substances.
- AS/NZS 3833:1998 Storage and Handling of Mixed Classes of Dangerous Goods in Packages and Bulk Containers.

- •AS 2430.3:1997 Classification of Hazardous Areas – Examples of Area Classification – General

Audit and Review

A biannual report on HS and DG will be supplied by the principal contractors site manager on the status of Hazardous Substances to the NT Regulator Worksafe NT. Weekly reports will be provided to the site manager by the site Health and Safety manager in relation to any instances or occurrences relating to HS and DG or follow up actions, and will ensure all correspondence and documentation is correctly managed and all public and occupational safety directives and legislation relating to HS and DG is properly enforced and reported.

In the event that a non-conformance, noncompliance or incident occurs then the management actions will include, where required:

- Investigation of the instance and corrective or management actions required.
- Review of associated documentation, procedures, policies on management of HS and DG, ensuring adherence to industry best practice.
- Update all relevant personnel on revised management practices relating to HS and DG, and its relevance to their position.

Noise and Vibration Management Plan

20 June 2016
Version 1.2

Document details	
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Contact details	Ali Youssef
Date and version	20 June 2016 Version 1.22
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1.2	20 June 2016	Ali Youssef	Addition of Site Management Structure. Final

Acronyms	
The following acronyms are used in this document	
Acronyms	Full form
DME	Department of Mines and Energy
NT	Northern Territory
NVMP	Noise and Vibration Management Plan
WRD	Waste Rock Dump
WSF	Waste Storage Facility

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Scope

The Noise and Vibration Management Plan (NVMP) identifies potential sources of noise generating activities associated with the construction works at Rum Jungle Mine Site (RJM), including associated borrow pit areas and haul roads; and its satellite sites of Rum Jungle Creek South (RJCS), Mount Fitch (MF) and Mount Burton (MB). It also provides an overview of control measures and methods which are necessary to manage and minimise the impacts of project-related noise and vibration on sensitive receptors.

This NVMP is to be implemented by all employees, at all times, whilst conducting noise and/or vibration-generating activities, which have the potential to impact sensitive receptors.

This document will be reviewed and updated once the construction tenders have been awarded and compliance criteria for noise and vibration levels have been set.

Objective

The intent of this plan is to avoid, minimise and manage the impacts of significant construction and operational noise and vibration, on the surrounding environment and sensitive receptors. It describes appropriate control measures for the management and reduction of noise emissions.

Site Management Structure

The following organisation chart (Figure 1) shows the anticipated management structure for the rehabilitation program. Positions and responsibilities for the Principal Contractor and any Subcontractors are not known at this stage. Once construction tenders have been awarded, this plan will be revised in order to reflect the contractors' management structure and position responsibilities.

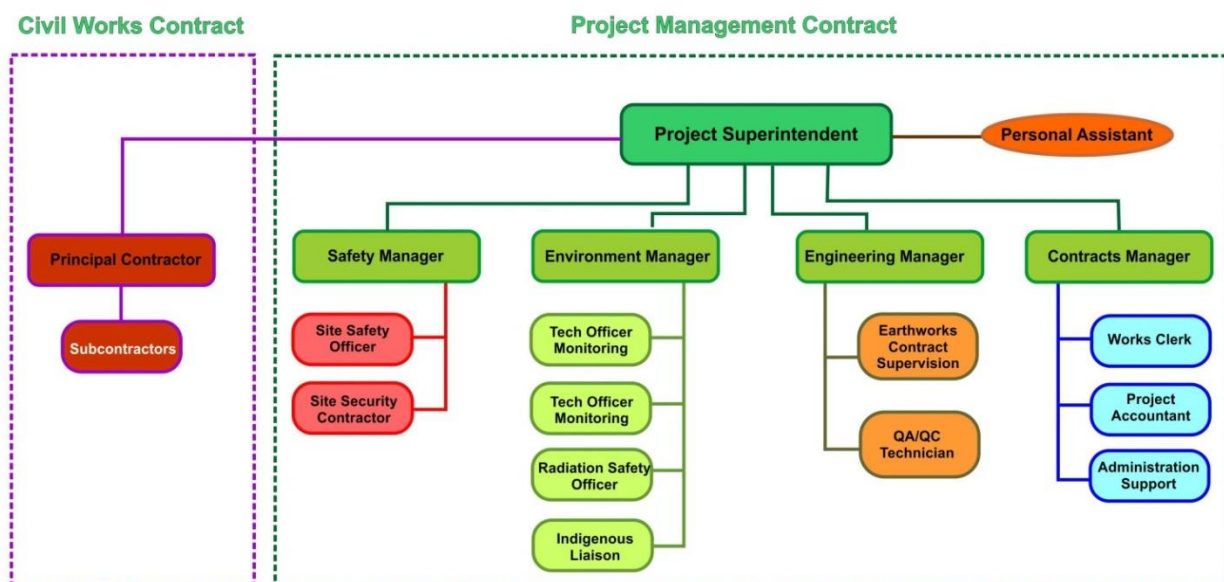


Figure 1. Organisational chart for the management of the rehabilitation project.

Potential Impacts

Pre-construction, construction and post-construction phases all have the potential to generate noise emissions which could impact nearby sensitive receptors (Table 1). Reasonable and practical measures are to be adopted in minimising the project generated noise and ensuring that noise levels do not exceed any set assessment criteria.

Noise assessments are to be undertaken to assess the compliance with operational noise criteria at all sensitive receptors.

Monitoring

Monitoring is to comprise of a mixture of attended and unattended monitoring at sensitive areas. This will aim to assess traffic and construction operational noise levels. Where monitoring identifies that operational noise is not within set criteria, a verification process will be implemented, involving additional monitoring. All related data is to be reviewed independently by a qualified acoustics engineer.

Complaints based monitoring will also be undertaken, on an as needed basis. This will be under an agreement between the impacted receptors, contractor and DME.

Noise Modelling

Noise levels are expected to be relatively low as the number and density of heavy vehicles is not expected to be high when compared to an operational mine site. This is to be substantiated through a combination of baseline assessments and a review of operational noise levels. As part of this, a predictive noise model, factoring background noise levels, is to be developed for defined meteorological conditions and highlight worst-case scenarios, as part the pre-construction phase studies.

Table 1. Construction activities likely to generate noise and vibration emissions.

Activity	Aspect
Mobilisation	Transporting of equipment to location
Site preparation	Construct all weather road access & tracks Construct bridge/causeway Construct flood levees Clear areas as required Office/crib infrastructure Prepare foundations Pit backfill infrastructure preparation Construct pads/hardstands Communications (satellite/mobile phones) Security, fencing, gating Install signage
Pumping Infrastructure	Additional boreholes Water treatment plant (pad and plant)
Power infrastructure	Installation of poles / wire Hook-up with Power & Water
Weed control	Finnis River Land Trust Borrow Pit Area. Gamba grass control. Other management practices (e.g. vehicle wash-down)
Dewater	Dewatering Main pit
Water treatment	Commence pump, collect, treat Ongoing weed management Site Maintenance – Haul roads/access tracks

Activity	Aspect
<p>Backfill Main Pit</p>	<p>Ongoing weed control and management</p> <p>Intermediate WRD - salvage rip rap</p> <p>Intermediate WRD - relocate to Main pit</p> <p>Intermediate WRD - rehabilitate footprint</p> <p>Borrow Material - clean fill to bring Main Pit to final landform level</p> <p>Dysons Pit Overburden - salvage rip rap</p> <p>Dysons Pit Overburden - relocate waste above nominated drainage layer and drainage layer to Main Pit</p> <p>Old Main WRD - salvage rip rap</p> <p>Old Main WRD - relocate waste to Main Pit</p>
<p>Finniss River Land Trust Borrow Pit</p>	<p>Prepare haul route</p> <p>Open Finniss River Land Trust Borrow Pit</p> <p>Ongoing weed control and management</p> <p>Rehabilitate the footprint</p> <p>Rehabilitate the haul road</p>
<p>New WSF</p>	<p>Prepare Foundation</p> <p>Main WRD - relocate waste to new WSF</p> <p>Place temporary (interim) liner on new WSF to protect during wet season</p> <p>Complete new drainage channel works as required and install all monitoring systems</p>

Activity	Aspect
New WSF	<p>Dysons WRD - relocate waste to new WSF</p> <p>Dysons WRD - rehabilitate the footprint</p> <p>Dysons Pit Overburden - install designed cover system</p> <p>Dysons Pit Overburden - revegetate cover system</p> <p>Start to place cover on new WSF - Borrow material</p> <p>Complete cover on new WSF - Borrow material</p> <p>Start to install new WSF monitoring system</p> <p>Revegetation of surface</p> <p>Complete new WSF cover and landform monitoring system - Borrow Material</p>
Creek Diversion	Commence construction of new creek around the Main Pit
Contaminated soils	Contaminated soil to be picked up and relocated to new WSF.
	Rehabilitate the contaminated soil area footprints
Old Main WRD	<p>Old Main WRD - rehabilitate the footprint</p> <p>Place temporary (interim) liner on old WRD to protect during wet season</p>
Infrastructure	Demobilise remaining infrastructure

Mitigation Measures

Where necessary, controls to prevent and minimise noise and vibration emissions may include the following: **Table 2.** Noise and vibration control measures likely to be adopted during the different phases of the project.

Source	Control Measure Type	Methodology	Responsibility	Monitoring and Reporting	Performance Measure
Site preparation / planning	Design / Procedure	<p>Noisy work to be restricted to daytime hours.</p> <p>Layout of site to factor in operational noise and vibration levels and potential impacts.</p> <p>Notify community in advance where noisy activities are likely to be a concern.</p>	Environment Manager	<p>Attended and unattended noise monitoring, where necessary.</p> <p>Environmental monitoring reports and review.</p>	<p>No community complaints.</p> <p>No monitoring exceedances.</p>
Infrastructure	Shielding / Procedure	<p>Use of quiet equipment; incorporating enclosed chambers or silencers and other noise attenuation devices where necessary.</p> <p>Selective placement of long-term equipment such as generators and</p>	Construction and Operations manager	<p>Attended noise monitoring and associated reporting.</p> <p>Environmental monitoring reports and review.</p>	<p>No community complaints.</p> <p>No monitoring exceedances.</p>

Source	Control Measure Type	Methodology	Responsibility	Monitoring and Reporting	Performance Measure
		<p>pumps.</p> <p>Minimise equipment use during off-peak hours.</p> <p>Equipment best practice maintenance and operations.</p>			
Haulage, dumping and vehicle movement	Design / Procedure / Shielding	<p>Use of low-tonal alarms where necessary.</p> <p>Traffic Management Plan to identify proposed routes and operation times.</p> <p>Minimise vehicle idling or queuing where possible.</p> <p>Vehicle speed limits.</p>	Construction and Operations manager	<p>Attended and unattended noise monitoring.</p> <p>Traffic Management Plan.</p> <p>Environmental monitoring reports and review.</p>	<p>No community complaints.</p> <p>No monitoring exceedances.</p>
Water treatment	Design	<p>Enclosed motor rooms and pump houses.</p> <p>Equipment best practice maintenance and operations.</p>	Environment Manager	<p>Attended and unattended noise monitoring.</p> <p>Environmental monitoring reports and review.</p>	<p>No community complaints.</p> <p>No monitoring exceedances.</p>
Earthworks and	Design / Procedure /	Use of low-tonal alarms where	Construction and	Attended and unattended noise	No community

Source	Control Measure Type	Methodology	Responsibility	Monitoring and Reporting	Performance Measure
Stockpiling	Shielding	<p>necessary.</p> <p>Traffic Management Plan to identify proposed routes and operation times.</p> <p>Minimise vehicle idling or queuing where possible.</p> <p>Equipment best practice maintenance and operations.</p> <p>Vehicle speed limits.</p>	Operations manager	<p>monitoring.</p> <p>Traffic Management Plan.</p> <p>Environmental monitoring reports and review.</p>	<p>complaints.</p> <p>No monitoring exceedances.</p>
Blasting	Design	<p>Whilst there is the potential for explosives use, all blasting activities will be designed to ensure that air blast and or vibration does not damage residences or areas of cultural significance.</p>	Construction and Operations Manager.	Noise and Vibration monitoring and review.	<p>No damage to any sensitive receptors.</p> <p>No community complaints.</p> <p>No monitoring exceedances.</p>

Environmental Training

All personnel shall undergo a basic site induction that outlines the environmental conditions and controls on-site. Noise and vibration awareness training will be incorporated into the site induction and will address the following:

- Awareness of construction noise and vibration and the need to operate as quietly as possible, in order to minimise the impact on sensitive receptors
- Location of sensitive receptors in respect to operational areas
- Noise and vibration monitoring and results for the site and sensitive receptors
- Awareness of weather conditions including high winds and inversions and their impacts on noise and vibration levels
- Procurement of new equipment and the requirement to 'Buy Quiet', where the opportunity exists
- The notification process, where works are likely to generate significant noise and vibration levels
- Approved working hours in relation to specific activities and procedures for high noise and vibration generating works

All personnel accessing the site will need to be deemed competent through the training and awareness programs relevant to their role and are responsible for ensuring they are in compliance with the NVMP at all times whilst on site.

Legislation and Guidelines

All activities shall be carried out in accordance with relevant legislation and statutory requirements. Whilst the NT does not have specific noise and vibration legislation, best practice will be adopted to the extent that it does not conflict with overarching legislation.

Commonwealth Legislation

- Protection of the Environment Operations Act 1997 (POEO Act)

Northern Territory Legislation

- Waste Management and Pollution Control Act 1998
- Mining Management Act 2015

Guidelines

- World Health Organisation (WHO) Guidelines for Community Noise, 1999
- AS 1055.1:1997 Acoustics - Description and measurement of environmental noise - General procedures
- AS 1055.2:1997 Acoustics - Description and measurement of environmental noise - Application to specific situations
- AS 1055.3 Acoustics - Description and measurement of environmental noise - Acquisition of data pertinent to land use
- AS 2187.2:2006 Explosives - Storage and use - Use of explosives.
- AS 2436:2010 Guide to noise and vibration control on construction, demolition and maintenance sites

Complaints Handling

A Complaints Register will be set up and maintained by the DME. All noise and vibration complaints will be investigated and verified and have appropriate mitigation measures implemented. Complaints will be referred to the Environment Manager and/or Construction Manager.

Audit and Review

The audit and review process is designed to ensure that the project maintains compliance with the NVMP. This will comprise of both internal and external audits and will consist of:

- The submission of an audit report to the DME
- Assess the adequate strategies, plans and programs as required
- Recommendations for appropriate measures or action to improve the environmental performance of the project
- Plan is to be amended with recommendations

Radiation Management Plan

22 June 2016
Version 1.1

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1.0	21 June 2016	Ali Youssef	First draft
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Acronyms	
The following acronyms are used in this document	
Acronyms	Full form
EPA	Environmental Protection Authority
MB	Mount Burton
MF	Mount Fitch
NORM	Naturally Occurring Radioactive Material
NT	Northern Territory
RMP	Radiation Management Plan
RSO	Radiation Safety Officer
RJCS	Rum Jungle Creek South
RJM	Rum Jungle Mine Site

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Scope

This Radiation Management Plan (RMP) addresses the potential radiological risk and necessary mitigation measures associated with the excavation, transport and placement of radiologically contaminated materials at the Rum Jungle Mine (RJM), Mount Fitch (MF) and Mount Burton (MB) sites. It provides mechanisms for the safe management and control of radiological exposures likely to impact humans, no-human biota or the environment during all activities. It outlines the systems and processes that will be put in place to ensure compliance with standards and regulatory requirements relating to radiation protection.

This document will be reviewed and updated following the award of the construction tenders and at annual intervals during the construction period.

Objective

To remove all avoidable radiation exposures associated with the excavation, transport and placement of contaminated materials, at Rum Jungle Mine and the associated sites at Mount Fitch and Mount Burton.

The RMP is designed to comply with various Codes of Practice including *Code of Practice & Safety Guide on Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing* (ARPANSA, 2005) and the *Code of Practice for the near-surface disposal of radioactive waste in Australia* (NHMRC (ARPANSA), 1992). Compliance with this RMP will assist in ensuring that radiation doses to workers, members of the public and the environment are kept 'As Low As Reasonably Achievable' (ALARA), as defined by the International Commission on Radiological protection (ICRP).

Site Management Structure

The following organisation chart (Figure 1) shows the anticipated management structure for the proposed works. Positions and responsibilities for the Principal Contractor and any Subcontractors are not known at this stage. Once construction tenders have been awarded, this plan will be revised in order to reflect the contractors' management structure and position responsibilities.

Currently, it is the responsibility of the Project Superintendent to ensure that all monitoring and works are carried out in accordance with the RMP and, where required, correctly documented.

The radiation sources are of low level so the presence of a radiation safety officer (RSO) is not necessary for the entire duration of the works. However, an RSO will:

- Be present during the initial personnel induction to ensure that safe working procedures have been adequately discussed with workers
- Conduct inspections at least weekly, to ensure that safe working practices are being maintained
- Be available for discussion of any issues and potential safety concerns that arise
- Brief the Project Superintendent on appropriate radiation safety oversight matters.

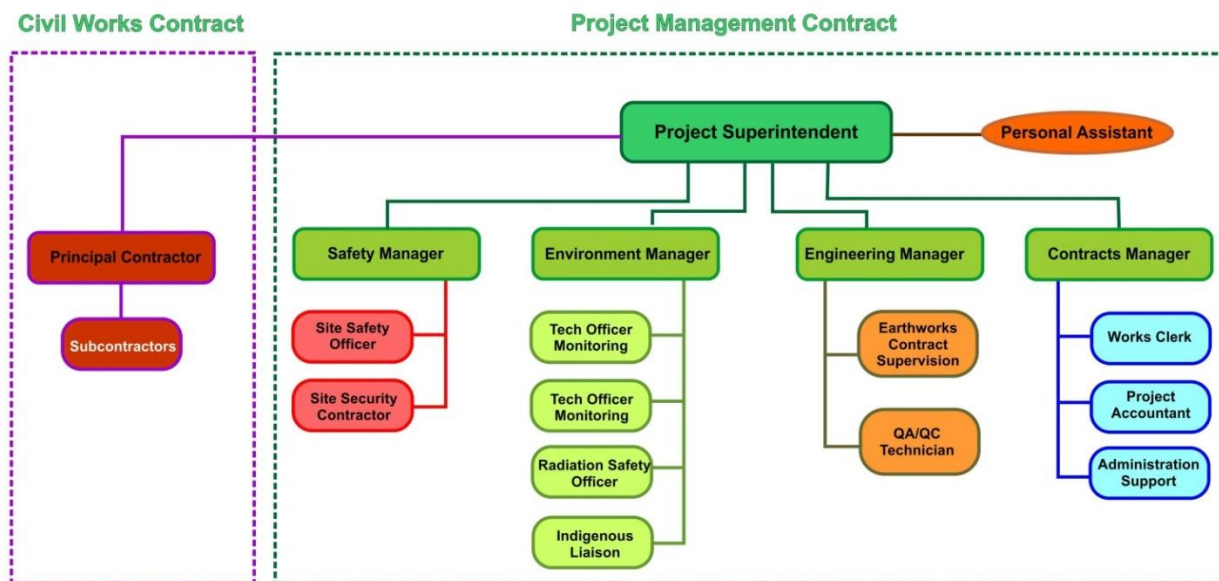


Figure 1. Organisational chart for the management of the rehabilitation project.

Potential Impacts

Pathways for Radiation Exposure

There are four pathways for exposure to radiation that can occur within the rehabilitation project. These are:

External exposure to gamma radiation

Irradiation can occur through exposure to gamma radiation from naturally occurring radionuclides in soils, mineralised ore or mining and milling waste from uranium mining.

Internal exposure from inhalation of radioactive dust (long-lived alpha activity)

Inhalation of airborne dust containing long-lived alpha-emitting: uranium, thorium, and radium. This is a potential concern with any dust-producing activity.

Inhalation of radon decay products (RDPs)

Radon decays to radon decay products (RDP) (^{218}Po , ^{214}Pb , ^{214}Bi , ^{214}Po). These are metals, and if inhaled are retained in the lungs. Their subsequent decay can result in large doses to the lungs. This is generally only a concern in enclosed spaces where RDP concentrations may accumulate, e.g. in an underground uranium mine.

Ingestion of radionuclides

Radioactive contamination can be transferred from hands to mouth when eating, drinking or smoking. An additional minor internal pathway is through radioactive contamination coming in contact with an open wound.

Radiation Protection Standards

These radiation protection arrangements have been designed to comply with all relevant legislation, including the *Australian Radiation Protection and Nuclear Safety Act 1998* and the National Standard for Limiting Occupational Exposure to Ionising Radiation [NOHSC:1013 (1995)] and the Radioactive Ores and Concentrates (Packaging and Transport) Act and regulations.

The proposed method of transport of radioactive materials complies with the Code of Practice for the Safe Transport of Radioactive Materials (ARPANSA, 2008), and the IAEA Regulations for the Safe Transport of Radioactive Material (IAEA, 2002) and relevant NT legislation.

Dose Limits

For occupational exposure, the effective dose above background shall not exceed 20 millisieverts (mSv) annually, averaged over five consecutive years, and shall not exceed 50 mSv in any single year (National Standard for Limiting Exposure to Ionizing Radiation (NOHCS, 1995a and b)).

Assuming that some personnel may be exposed to other sources of radiation in other work in the same year the limit should be 5 mSv over the three month period. The annual equivalent dose shall not exceed:

- 150 mSv to the lens of the eye;
- 500 mSv to the hands and feet; and
- 500 mSv to the skin (average dose received by any one square centimetre of skin).

For public exposure, the annual effective dose must not exceed 1 millisievert (mSv) (NOHCS, 1995a and b).

Persons under the age of 18 are not allowed to work in a controlled area under any circumstances. They may visit radiologically classified areas for educational purposes, provided the Project Superintendent or delegate accompanies them.

The Northern Territory Department of Mines and Energy (NT DME) is committed to ensuring that all exposures to ionising radiation are ALARA.

Dose Monitoring

While the overall operation represents an existing situation, with materials below regulatory dose limit guidelines, the work involved in moving, storing and disposing of the tailings and any other contaminated materials is a planned exposure and is subject to the recommendations and dose limits in the Radiation Health Series 39, National standard for limiting occupational exposure to ionising radiation (NOHSC, 1995), and Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards (IAEA, 2014).

The ambient gamma dose rate measurements will be measured using a portable high-sensitivity dose rate meter with measurements being taken one metre above ground for an appropriate length of time.

Monitoring will include the collection of dose rate conditions on site and the assessment, interpretation and evaluation of this information (area monitoring). This, together with information on exposures to individuals (individual monitoring), will assist in establishing and enforcing safe working practices and engineering standards, and that radiological hazards are under effective control in a way which complies with international best practice and regulatory requirements.

The first type of monitoring (area) is based on survey measurements taken on the site where work is being undertaken. The second (individual) is based on measuring exposure to radioactivity, using personal dosimetry.

Routine monitoring is the foundation of the operational monitoring program, and consists of planned monitoring that confirms the radiological conditions and levels of individual dose are meeting radiation protection requirements and objectives.

Task-related monitoring applies to a specific task, and can be used to provide data on the safe management of the task and inform decisions on protection techniques and their optimisation.

Routine Area Monitoring

The purpose of routine area monitoring is summarised above, and more specifically is to:

- Confirm effective control of sources of radiological hazards in all areas by the use of safe working procedures and engineering features
- Confirm the area classifications and any changes in radiological conditions
Evaluate real and potential dose rates.

High-sensitivity portable meters will be used for routine area monitoring. Measurements will be carried out daily at each site while material is being reclaimed (and the containment sites once contaminated materials are being transported); the results will be recorded. High volume air samplers will also be used at appropriate locations.

Task related Area Monitoring

Task-related area monitoring will use similar equipment to that described for routine area monitoring measurements. ALARA and dose reduction assessment monitoring for a specific activity or group of activities is an example of this type of monitoring. It is anticipated that this may occur at times when specific tasks are being undertaken during the remedial works. An example would be monitoring the immediate area around excavations, prior to entering these excavations.

Individual Monitoring

This monitoring will consist of measurement of radiological exposure to an individual. Monitoring of occupationally exposed workers will be performed for selected personnel working in close contact with the contaminated materials. This will include the Project Superintendent and the individual responsible for the clearance surveys (the RSO or delegate). These individuals are expected to have closer contact with the radiological sources and will be monitored accordingly. In addition, individual monitoring should be conducted on one of the construction personnel to determine the overall individual dose that is received by individuals spending time mainly inside vehicles and equipment.

Personal monitoring will consist of having selected individuals using electronic dosimeters for effective (gamma) dose assessment. All staff will be required to wear thermoluminescent dosimeters which will be assessed at intervals of 3 months. Results of the individual monitoring will be recorded in compliance with regulatory requirements.

Dust Monitoring

Dust concentration measurements and determinations of radioactivity concentrations in the air will be carried out regularly to determine radioactive elements 'trapped' in or on dust.

Work place measurements will be used to determine the radiation doses of the workers engaged in the rehabilitation works, and measurements along the haulage routes will be used to monitor the dose to workers and the general public.

A continuous flow air sampler will be used to determine the concentration of long-lived, dust-borne, alpha emitters. Filters will be submitted to a certified laboratory for analysis on a monthly basis and the results shall be recorded in compliance with regulatory requirements.

Radon Monitoring

Radon monitoring will be undertaken at the working sites. One long term monitor will be used at the existing contaminated sites and moved with the works' progress. The long term monitor will be a solid state nuclear track etching detector installed at 1.5 m above ground. The start and end dates of the exposure of the track detector will be recorded and the readings will be interpreted by the RSO. In addition, measurement of radon progeny potential alpha energy concentration will be measured at each site on a bi-weekly basis for 24 hour periods.

Short term measurements will be taken with a radon monitor at each site (excavation) at least once per week. This monitor will be portable with a direct read out, with a short time interval for integrating measurements.

The results of all radon monitoring will be recorded in compliance with regulatory requirements.

Clearance Monitoring

The clearance limits for the rehabilitation works will be 1.25 $\mu\text{Sv/hr}$ ($\pm 20\%$).

After the contaminated material has been removed, each site will require a high resolution monitoring programme for clearance of the sites. Clearance monitoring will employ the same (or similar) portable instruments as those used for site monitoring.

Clearance surveys of the roadways will be undertaken to ensure that no materials have been spilled during transport. Areas that need monitoring in particular are those where the potential for spillage is high, such as at corners, haul truck turnarounds and the initial 200 m of roadway from each site. Results of these measurements will be recorded. The road clearance monitoring will be undertaken prior to the works starting at specified areas and will continue on a weekly basis until the works are completed. Visual checks for spilled materials will also be undertaken (at least daily) along roadways.

All equipment that has potentially been exposed to contaminated material will be cleaned and checked for contamination before being allowed to leave the project area at the completion of the works program. Materials will be decontaminated for recycling, however in some cases it is expected that the materials will have to be disposed of on-site. The materials will be decontaminated on a wash down pad which drains into on-site approved retention ponds.

No piece of earthmoving equipment shall be allowed to leave the site without:

- A completed radiation clearance certificate; and,
- Written approval from the Project Superintendent.

Results of these clearance survey measurements will be recorded.

Transportation

The Code of Practice for the Safe Transport of Radioactive Material, 2008 edition (ARPANSA, 2008) was used to determine transport guidelines. All references to tables, figures or paragraphs in this section have been derived from this code of practice and the NT Radioactive Ores and Concentrates (Packaging and Transport) Act

The materials being transported from Mount Burton are defined as LSA-I type materials as per the following definition:

LSA-I (Para. 226)

- *Uranium and thorium ores and concentrates of such ores, and other ores containing naturally occurring radionuclides which are intended to be processed for the use of these radionuclides;*
- *Natural uranium, depleted uranium, natural thorium or their compounds or mixtures, providing they are un-irradiated and in solid or liquid form;*

These materials will be under exclusive use therefore the LSA-I materials will be classified as an Industrial package Type 1 (IP-1).

The Code of Practice specifies that IP-I material may be transported unpackaged when under conditions specified in para. 523, which specifies that:

- *All unpackaged material other than ores containing only naturally occurring radionuclides shall be transported in such a manner that under routine conditions of transport there will be no escape of the radioactive contents from the conveyance nor will there be any loss of shielding;*
- *Each conveyance shall be under exclusive use.*

IP-I shipments have no activity limit for conveyances by road. *The quantity of LSA material or SCO in a single Type IP-1, Type IP-2, Type IP-3, or object or collection of objects, whichever is appropriate, shall be so restricted that the external radiation level at 3 m from the unshielded material or object or collection of objects does not exceed 10 mSv/h (para. 521), which is the case for material being brought in to Rum Jungle from Mount Burton.*

Placarding of transport vehicles (haul trucks) will comply with LSA-1(IP-I) codes of practice and signs will be clearly displayed on both external lateral walls of the vehicle and on the rear wall.

Incidents and Emergency Response

All radiation related incidents must be reported to the site RSO or nominated delegate. If required the RSO or nominated delegate will:

- Investigate the incident
- Undertake monitoring where it is deemed necessary
- Calculate exposures to workers/public
- Determine reporting requirements
- Provide advice on mitigating actions, decontamination etc.
- Provide counsel to workers involved
- Record incident and corrective actions

Control Measures

Table 2. Radiation control measures to be adopted during the different phases of the project.

Control Measures	Timing	Methodology	Responsibility	Monitoring and Reporting	Performance Measure
Site preparation / planning					
All site personnel are to be informed of the requirements of this plan and the importance of site radiation management prior to accessing site	All phases	Site inductions, pre-start meeting, toolbox talks and safety shares	All site personnel	Training and induction records	All site employees attend site inductions and toolbox talks
General					
Contaminated clothing and PPE to remain on site. Clothing will be laundered onsite. All workers to shower at the end of shift.	All phases	Shower and change of clothes is mandatory prior to leaving sites. Site Inductions including radiation section.	All site personnel	Inspections.	No report of site clothing outside the boundary.
Haulage, dumping and vehicle movement					
Material is to be damp prior to moving, in order to	Construction phase	Dust suppression may utilise sprinklers and/or automatic	Construction and Operations Managers	Daily inspections and monitoring of construction	No visible dust.

Control Measures	Timing	Methodology	Responsibility	Monitoring and Reporting	Performance Measure
minimise dust generation		sprays where a strong likelihood of dust generation exists		activities	
Avoid material movement or disturbance during times of high winds or extreme weather events.	Construction phase	Weather predictions and forecasting are to be used to plan site works so as to avoid high winds and extreme weather. To be factored into work schedule.	Construction and Operations Managers	Daily inspections and monitoring for dust generation.	No visible dust. Radiation monitoring results.
Contaminated material to be covered during haulage.	Construction phase.	Covers on loads to be used.		Daily inspections and audits	
Stockpiling					
Stockpiling of materials should be away from sensitive receptors (includes offices and crib rooms)	Pre-construction phase Construction phase	Water sprays and water carts Synthetic films where necessary Design limits for stockpile dimensions	Construction and Operations Manager	Daily inspections Dust monitoring Daily work plan Weather forecasting	No visible dust Radiation monitoring results.
Maintain damp material	Construction phase	Where necessary and humidity levels are low sprinklers to be used on stockpiles to	Construction and Operations Managers	Daily inspections	No visible dust off stockpiles. Radiation monitoring

Control Measures	Timing	Methodology	Responsibility	Monitoring and Reporting	Performance Measure
		maintain dampness in haulage material.			results.
Contaminated materials handling					
Minimise potentially contaminated dusts being generated from any contaminated soils	Construction phase	Material is to be damp prior to moving, in order to minimise dust generation.	Construction and Operations Managers	Daily inspections Hazardous Materials Management Plan and soil assessments	No dust generated from contaminated areas on site.
Adhere to radiation management plan guidelines for the site relating to all radioactive materials or wastes	All phases	As per Radiation Management Plan	Environmental Manager Construction and operation managers Site management may delegate specific contract managers management of individual areas or particular hazardous substances based on activities or usage.	Site supervisors will conduct regular radiation monitoring of waste materials for disposal Site management will conduct and regularly review environmental and OH&S radiation monitoring Radiation monitoring will be reported and reviewed at regular site management meetings during operational phases	Site management will implement and regularly review the Radiation Management Plan All site personnel will adhere to the Radiation Management Plan requirements

Environmental Training

All personnel shall undergo radiation awareness training as part of the site induction.

The areas to be covered will include:

- Risks associated with radiation
- Site procedures around change of work clothing and showering after shift
- The use of water trucks, misters and sprays where necessary, in order to keep dust levels to a minimum
- Covering of loads where necessary
- Radiation monitoring conducted on site
- The notification process, where excessive dust generation is visible

All personnel accessing the site are responsible for ensuring they are in compliance with RMP at all times whilst on site.

Legislation and Guidelines

All activities shall be carried out in accordance with relevant radiation legislation and statutory requirements.

Commonwealth Legislation

- Protection of the Environment Operations Act 1997
- ARPANSA 2005. Code of Practice on Radiation Protection and Radioactive Waste Management in Mining and Mineral Processing. Australian Radiation Protection and Nuclear Safety Agency.
- ARPANSA 2008. Code of Practice on the Safe Transport of Radioactive Material. Australian Government.
- ARPANSA AND NOHSC 2002. Recommendations for Limiting Exposure to Ionizing Radiation (1995) (Guidance Note [NOHSC:3022(1995)]) and National Standard for Limiting Occupational Exposure to Ionizing Radiation [NOHSC:1013(1995)] Republished March 2002. Commonwealth of Australia.
- ARPANSA 2014 Fundamentals for Protection Against Ionising Radiation Commonwealth of Australia
- Radioactive Ores and Concentrates (Packaging and Transport) Act
- ARPANSA 1992 (Previously NHMRC Code) Code of Practice for the Near-Surface Disposal of Radioactive Waste in Australia.

Northern Territory Legislation

- Radiation Protection Act
- Mining Management Act
- Radioactive Ores and Concentrates (Packaging and Transport) Act

Audit and Review

The audit and review process is designed to ensure that the project maintains compliance with the RMP and relevant legislation. This will include both internal and external audits and will consist of:

- The submission of an audit report to the DME annually
- Assessment of strategies, plans and programs, at least annually
- Developing recommendations for appropriate measures or action to improve the environmental performance of the project as a plan for continuous improvement
- Ensuring any necessary amendments arising from the previous activities are incorporated into this plan.

Water Management Plan

20 June 2016
Version 1.2

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Acronyms	
The following acronyms are used in this document	
Acronyms	Full form
ANZECC	Australian and New Zealand Environment Conservation Council
ARMCANZ	Agricultural Research Management Council of Australia and New Zealand
CEMP	Construction Environmental Management Plan
DME	Department of Mines and Energy
EBFR	East Branch Finniss River
EPA	Environmental Protection Authority
FRLT	Finniss River Lands Trust
LDWQO	Locally-Derived Water Quality Objectives
NT	Northern Territory
NWQMS	National Water Quality Management Strategy
WDL	Waste Discharge Licence
WMP	Water Management Plan
WRD	Waste Rock Dump
WSF	Waste Storage Facility

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Scope

The Water Management Plan (WMP) addresses the management, monitoring and assessment of all water management related issues throughout all phases of the construction works at Rum Jungle Mine Site (RJM) and its satellite sites Mount Fitch, Mount Burton, associated haul roads and Borrow Area – located on the Finniss River Land Trust. The WMP incorporates mitigation and contingency measures, which are able to be implemented where impacts on surface water or groundwater quality have been identified, or where incidents or threats to water quality are likely to occur.

The WMP provides:

- A coordinated and comprehensive approach to reducing potential environmental and human health impacts associated with surface water and groundwater quality, during all phases of the rehabilitation works
- A consistent process of assessment to reduce uncertainty over the project duration through inclusive monitoring programs
- A guide to enable contractors and regulators to measure compliance with the site's water quality criteria and to identify corrective actions where monitoring or inspections indicate an issue

This document will be reviewed and updated once the construction tenders have been awarded and prior to commencement of the works.

Objective

The following are the objectives for the management of water quality during the project:

- Minimise potential risks to the water quality of the surrounding environment, including downstream of the Finniss River
- Implement methods to ensure compliance with appropriate regulatory standards and codes of practices relating to water quality management

Site Studies

The development of the Rum Jungle Mine site rehabilitation strategy and design, involved the review of numerous site characterisation studies. These studies contain all the appropriate background information that characterise the surface water and groundwater conditions of the Rum Jungle Mine site and downstream in the Finniss River system. Detailed information on the Rum Jungle Mine site, the geological, hydrological, hydrogeological and ecological conditions and proposed rehabilitation engineering designs, can be found on the project website:

<https://minerals.nt.gov.au/rum-jungle-mine/completed-studies>

Surface water and Groundwater Studies

Numerous surface and groundwater studies were conducted during mining, post-mining works. In 2010 the NT Department of Mines and Energy (DME) commissioned a gap analysis that resulted in a number of detailed studies of the physical and chemical properties of both the surface and groundwater systems associated with the Rum Jungle Mine site. These are listed below:

- Hydrogeological Study Of Rum Jungle Mine Site - Initial Review & Data Gap Analysis (Phase 1) - Rev0 RGC, Ferguson & Wels. 2010
- Phase 2 Report - Detailed Water Quality Review & Preliminary Contaminant Load Estimates, Rum Jungle Mine Site, NT. RGC, Ferguson & Wels. 2011
- Phase 3 (Stage 1 Report): Development Of Conceptual Flow Model For The Rum Jungle Mine Site RGC, Ferguson & Wels. 2011
- Phase 3 (Stage 2 Report): Report On Numerical Groundwater Flow Modelling At The Rum Jungle Mine Site, NT. RGC, Ferguson & Wels. 2012
- Phase 3 (Stage 3 Report): Surface Water Quality And Contaminant Load Assessment For The Rum Jungle Mine Site, NT, Ferguson & Wels.2012
- Rum Jungle Flood Study – 1in 100 AEP, R. Walton, Water Technology Pty Ltd, 2014
- Rum Jungle Flood Study - Site Visit Report, R. Walton, Water Technology Pty Ltd, 2014
- Rum Jungle Mine Site, Main Pit Backfilling Concept Approaches Study Report No. 183006/4. RGC, Ferguson & Wels. 2015

Ecological Studies

To assess the most recent ecological conditions in the vicinity and downstream of the Rum Jungle Mine site and to develop Locally Derived Water Quality Objectives (LDWQOs) for the project, ecological, sediment and water quality studies were conducted. This determined existing impacts and outlined water quality objectives for the rehabilitation project. The studies are as follows:

- Environmental Values Downstream of the Former Rum Jungle Minesite – Phase 1 Hydrobiology Pty Ltd. Markham et al. 2013.
- Environmental Values Downstream of the Former Rum Jungle Minesite – Phase 2 Hydrobiology Pty Ltd. Markham et al. 2013.
- Rum Jungle Aquatic Ecosystem Survey. Early Dry Season 2014, Markham et al, Hydrobiology Pty Ltd 2014.
- Rum Jungle Aquatic Ecosystem Survey, Early and Late Dry Season 2015, October 2015 Markham et al, Hydrobiology Pty Ltd 2015.
- Rum Jungle Impact Assessment, Preliminary Report February 2015., Markham et al, Hydrobiology Pty Ltd 2015.
- Rum Jungle Impact Assessment, Final Report October 2015., Markham et al, Hydrobiology Pty Ltd 2015.
- Rum Jungle Impact Assessment, Floodplain Tailings Investigation, March 2016. Markham et al, Hydrobiology Pty Ltd 2015.

Legislation and Guidelines

All activities shall be carried out in accordance with relevant regulatory requirements these include:

Commonwealth Legislation

- *Protection of the Environment Operations Act 1997 (POEO Act)*
- *National Environment Protection Measures (Implementation) Act 1998*

Northern Territory Legislation

- *Water Act 2013*
- *Water Regulations 2008*
- *Waste Management and Pollution Control Act 2016*
- *Northern Territory Environment Protection Authority Act 2014*
- *Environmental Assessment Act 2013*

Guidelines and Codes of Practice

- National Water Quality Management Strategy: Australian Guidelines for Fresh and Marine Water Quality(NWQMS) (ANZECC/ARMCANZ, 2000);
- Dams Safety Act 1978;
- Guidelines on Managing Urban Stormwater Soils and Construction for mines and water
- Construction techniques for sediment pollution control (publication 275)
- Environmental guidelines for major construction sites (publication 480)
- Keeping our stormwater clean – a builder’s guide

Licencing

The Northern Territory Environment Protection Authority (NT EPA) has been delegated the power to grant waste discharge licences (WDL) for discharge of waste to water under section 74 of the *Water Act*.

In the NT a WDL is issued as a legislative instrument to regulate the quality and quantity of pollutants discharged to the water. This ensures that operational activities are conducted in a manner consistent with the principles of social, economic and environmental responsibility.

The WDL is an authorisation under the *Water Act* (2013) that allows waste to be discharged or come in contact with water.

The submission for a WDL will require the inclusion of:

- The detailed location and boundaries of the site and all associated activities
- Detailed activities associated with the WDL
- Details of discharge points and proposed mixing zones
- Water requirements and potential impacts (outlined under Section 90 of the *Water Act*)
- Justification for a WDL
- Discharge specifications
- Monitoring plans
- Conceptual Site Model
- Environmental aspects and impacts register

- Emergency response plan
- Consultation and communication plan

Detailed requirements are outlined in the NT EPA's *Guidelines On Waste Discharge Licensing Under the Northern Territory Water Act 2014*.

Site Management Structure

The following organisation chart (Figure 1) shows the anticipated management structure for the rehabilitation program. Positions and responsibilities for the Principal Contractor and any Subcontractors are not known at this stage. Once construction tenders have been awarded, this plan will be revised in order to reflect the contractors' management structure and position responsibilities.

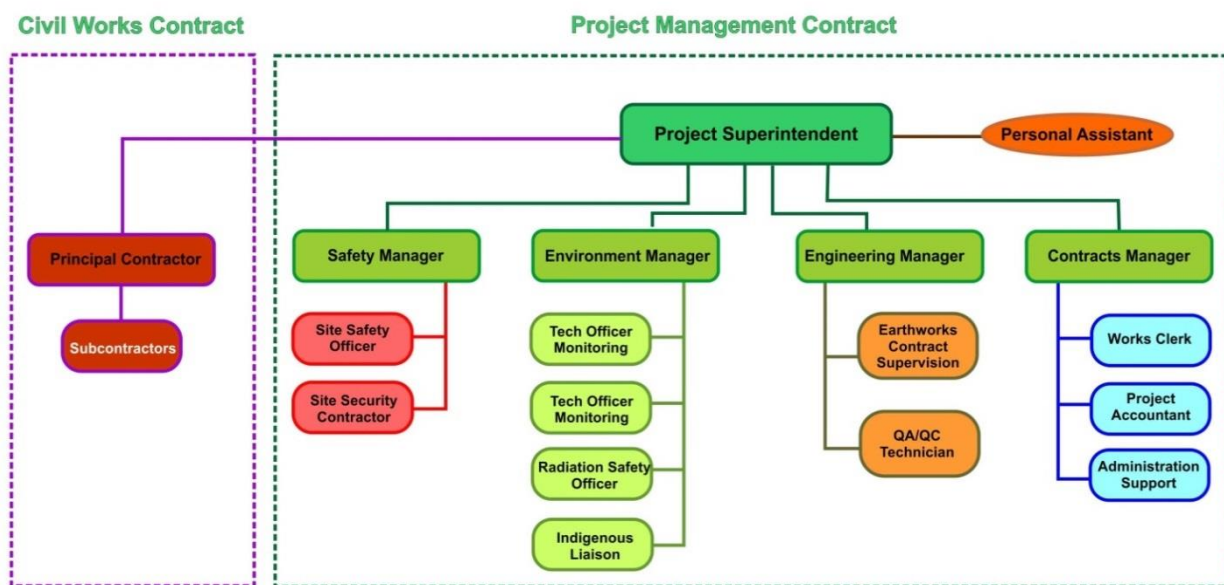


Figure 1. Organisational chart for the management of the rehabilitation project.

Potential Impacts

The WMP aims to identify risks in respect of potential impacts to surface and ground waters and to propose management strategies to manage those risks and identify appropriate mitigation measures should any impacts be detected through monitoring.

Control Measures

The following control measures (Table 2) have been assessed for all site aspects which pertain to water, as part of the project.

Table 2. Control measures to be adopted during the different phases of the project.

Control Measures	Timing	Methodology	Responsibility	Monitoring and Reporting	Performance Measure
All Site Aspects					
Erosion and sediment control	All phases	As per construction industry best practice and Erosion and Sediment Control Guidelines (see Legislation Section)	Construction and operation managers Environment Manager	Principal contractors will develop and implement an Erosion and Sediment Control Management Plan Surface water quality to be regularly monitored, sampled, tested and reported All drainage systems and water courses will be regularly inspected All significant occurrences of erosion will be reported to site management Uncontrolled releases will be	The long term structural integrity of water courses and channels are to be maintained onsite The water quality objectives for surface water, groundwater and discharged wastewater will adhere to specific criteria values The structural integrity of rehabilitated areas and landforms will allow for surface water runoff and major weather and precipitation events

Control Measures	Timing	Methodology	Responsibility	Monitoring and Reporting	Performance Measure
				<p>reported to the appropriate authorities</p> <p>Aquatic and riparian flora and fauna will be regularly monitored and reported</p>	
Surface water runoff management	All phases	<p>All surface water runoff from landforms will be managed by detailed engineering design works</p> <p>All impacted surface waters will be held in settlement dams or processed by the water treatment plant</p>	<p>Construction and operation managers</p> <p>Environment Manager</p>	<p>All treated water discharges will be monitored to comply with associated licences</p> <p>Surface water quality to be regularly monitored, sampled, tested and reported</p> <p>All drainage systems and water courses will be regularly inspected</p> <p>Significant uncontrolled releases or licence non-conformances will be reported to the appropriate authorities</p>	The water quality objectives for surface water, groundwater and discharged wastewater will adhere to specific criteria values

Control Measures	Timing	Methodology	Responsibility	Monitoring and Reporting	Performance Measure
				Potential impacts to the aquatic and riparian flora and fauna will be regularly monitored and reported	
Fuel storage and management		Addressed in the Hazardous Materials and Dangerous Goods Management Plan			
Uncontrolled spill response		Addressed in the Hazardous Materials and Dangerous Goods Management Plan			
Road cleaning, dust suppression and spraying Vehicle wash down	All phases	As per industry best practice guidelines As per requirements of Waste Discharge Licence	Construction and operation managers Site supervisors	All drainage systems and water courses will be regularly inspected Uncontrolled releases will be reported to the appropriate authorities	No hazardous materials are to be released into the environment Suitable management, containment and disposal measures are implemented in the eventuality of a

Control Measures	Timing	Methodology	Responsibility	Monitoring and Reporting	Performance Measure
					<p>release</p> <p>The water quality objectives for surface water, groundwater and discharged wastewater will adhere to specific criteria values</p>
Wastewater and sewage management	Construction phase	<p>As per <i>Waste Management and Pollution Control Act, Water Act</i> and Guidelines (see Legislation Section)</p> <p>As per conditions of Waste Discharge Licence</p>	<p>Construction and operation managers</p> <p>Site supervisors</p> <p>Environment Manager</p>	<p>Water treatment monitoring and reporting will be continuous during operational phases</p> <p>Uncontrolled releases to be reported to the appropriate authorities</p> <p>Surface water quality to be regularly monitored, sampled, tested and reported</p> <p>Reporting will be undertaken as per conditions of the Waste Discharge Licence</p> <p>Potential impacts to</p>	<p>No hazardous materials are to be released into the environment</p> <p>Suitable management, containment and disposal measures are implemented in the eventuality of a release</p> <p>The water quality objectives for surface water, groundwater and discharged wastewaters will adhere to specific criteria values</p>

Control Measures	Timing	Methodology	Responsibility	Monitoring and Reporting	Performance Measure
				the aquatic and riparian flora and fauna will be regularly monitored and reported	
Material stockpiling	Construction phase	As per construction industry best practice and Erosion and Sediment Control Guidelines (see Legislation Section) Stockpiling locations will be situated away from environmentally sensitive locations	Construction and operation managers	Material stockpiling will designed and located to minimise surface water runoff and be visually inspected regularly	No hazardous substances or dangerous goods released into the environment The structural integrity of stockpiled materials will allow for surface water runoff and major weather events
Alteration of water courses Sediment deposition and geomorphology of landforms	Construction phase	All alteration of water courses will be managed by detailed engineering design works	Construction and operation managers Environment Manager	Surface water flow will be monitored Erosion and water course geomorphology will be regularly monitored and reported Potential impacts to the aquatic and riparian flora and fauna will be	The structural integrity of the altered water course and surrounding landforms will allow for surface water runoff and major weather events The water quality objectives for surface waters, groundwaters and discharged wastewaters will

Control Measures	Timing	Methodology	Responsibility	Monitoring and Reporting	Performance Measure
				regularly monitored and reported	adhere to specific criteria values
Groundwater extraction management	Construction phase	Sufficient groundwater bores will be installed to undertake groundwater extraction Impacted groundwater will be pumped to the water treatment plant	Construction and operation managers Environment Manager	A groundwater monitoring program will be implemented throughout all project operational phases Contaminant flow modelling will be undertaken to assess groundwater impacts and regularly reported	The water quality objectives for groundwater will adhere to specific criteria values
Licencing and compliance	All phases	As per <i>Waste Management and Pollution Control Act, Water Act</i> and Guidelines (see Legislation Section) As per requirements of WDL	Department of Mines and Energy Northern Territory Environment Protection Authority Construction and operation managers Environment Manager	Reporting and monitoring of all surface waters and groundwaters will occur as per requirements of the WDL and site environmental management requirements	The water quality objectives for surface waters, groundwater and discharged wastewaters will adhere to specific criteria values

Water Management Strategy

Individual management plans relating to water management will include:

- Surface water
- Groundwater
- Water treatment
- Erosion and sediment control
- Acid mine drainage
- Cyclone response
- Management of voids

The Principal Contractor will provide detailed plans for these major elements, relating to all phases of rehabilitation.

Water Sources

Construction Water Supply

Details of required water volumes and water sources for construction will be provided in the Construction Environmental Management Plans (CEMPs) required for various components of project infrastructure. The CEMP will be provided by the Principal Contractor and will include information on the proposed measures to monitor water usage volumes. Construction water demands for each stage of the construction schedule will be calculated and included in the CEMP.

Pit water

The preferred rehabilitation strategy allows for the dewatering of Main Pit, and for the Intermediate Pit water to remain *in-situ* as a dilution source for treated water. Water from the top 20m of Main Pit is currently of good quality and may be utilised for onsite maintenance requirements.

Groundwater Inflow

Groundwater seepage will be dewatered from Main Pit and, dependent on quality, may either be pumped to Intermediate Pit or to the water treatment plant for processing.

Impacted Surface and Ground Water

Impacted surface water and extracted groundwater will be pumped to the water treatment plant prior to being discharged to Intermediate Pit.

Potable Water

Potable water will either be supplied by trucks and/or potable water bores.

Surface water and Groundwater Monitoring

Constructed landforms will be monitored to determine surface water quality runoff and impacts to groundwater as a result of the rehabilitation. This will allow for the timely management of any potential impacts resulting from the project. All water monitoring programs will follow Australian Standards, and where unavailable, industry best practice.

Monitoring will also include real time weather monitoring, quarterly assessment of erosion control and sediment retention devices, monthly surface water quality monitoring and biannual groundwater quality monitoring.

Site Water Balance

The site water balance will be regularly reviewed and updated as additional information becomes available.

Recording the following parameters will assist in validating the assumptions of the water balance model:

- Rainfall
- Pit and dam volumes
- Pumping rates between water storage locations
- Actual demand volumes for operation and maintenance
- Surface water catchment, major landform drainage and creek flows
- Actual groundwater inflows
- All discharge volumes offsite

Water Quality Targets

The water quality targets for surface water and groundwater are the LWDQOs, which are outlined in the reports included in the Site Studies section of this plan. Water Quality targets for discharge licences and operational activities will be derived from the LDWQOs, and will be based on achieving a percentage of these targets.

Surface and Groundwater Response Plan

Criteria Exceedance Procedure

Where monitoring has detected a potential water quality exceedance, the following procedures will be implemented:

- The time and location of the exceedance will be confirmed.
- The climatic conditions of the condition at the time of the exceedance will be recorded.
- Contributing factors are to be identified.

- Validate data.
- Develop appropriate mitigation and management strategies.
- Implement the mitigation and management strategies.
- Review subsequent results.
- Report the exceedance to the appropriate authorities.

The principal contractor will provide a contingency plan for unplanned events relating to water management as part of the CEMP.

Environmental Training

All personnel shall undergo environmental management awareness training as part of the site induction; this will cover water management. The Principal Contractor will be responsible for providing any further training relevant to water management.

The areas to be covered will include:

- Water management within respective work areas
- Awareness of inclement weather and its potential to generate water pollution
- The storage and handling of materials which could impact surface water and/or groundwater, (see Hazardous Materials and Dangerous Goods Management Plan)
- The notification process; where a spill, or uncontrolled release to surface water and/or groundwater has occurred
- The reporting of drainage, erosion or water storage failures.

All personnel accessing the site are responsible for ensuring they are in compliance with WMP at all times whilst on site.

Audit and Review

In the event of a non-conformance, non-compliance or incident, the subsequent management actions may include:

- Initial investigations and immediate corrective or management actions
- Revision of associated documentation, procedures, and policies on management of water quality; ensuring compliance with best practice and accordance with Environmental Management Plan objectives
- Updating of all documentation, ensuring they are made available in an accessible location

- Updating all relevant personnel on revised management practices relating to water quality management and its relevance to their role